United States
Environmental Protection
Agency

Office of Pollution Prevention
and Toxics (7406)
Washington, DC 20460

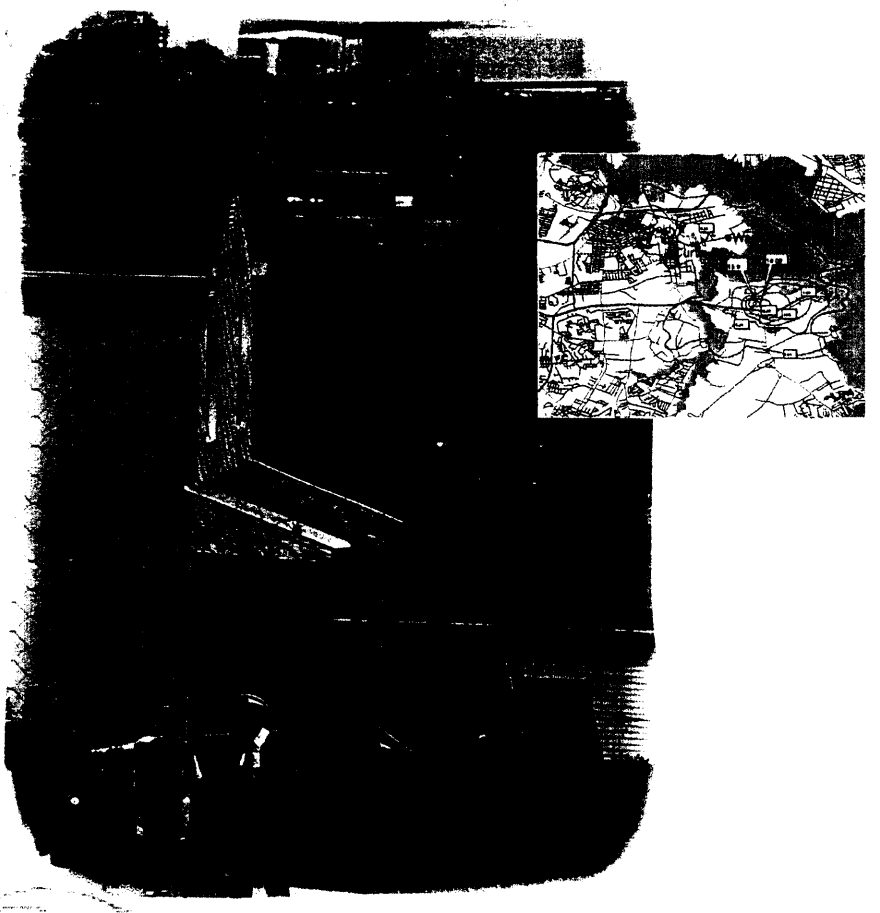
EPA 744-R-00-005
April 2000

EPA

Baltimore Community Environmental Partnership Air Committee Technical Report

Community Risk-Based Air Screening:

A Case Study in Baltimore, MD



A Product of the Community Environmental Partnership

EPA 744-R-00-005
April 2000
Final Report

Baltimore Community Environmental Partnership
Air Committee Technical Report

Community Risk-Based Air Screening:
A Case Study in Baltimore, MD

U.S. Environmental Protection Agency
Office of Pollution Prevention and Toxics
Washington, DC 20460

April 30, 2000

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

Page No.

LIST OF APPENDICES

LIST OF TABLES

LIST OF FIGURES

ACKNOWLEDGMENTS

This report is a summary of work done by the Air Committee of the Baltimore Community Environmental Partnership from 1996 through 1999. The report was prepared by technical staff of the U.S. EPA Office of Pollution Prevention and Toxics for the Air Committee of the Baltimore Community Environmental Partnership. The main EPA authors of the text were David Lynch, Greg Macek, and Hank Topper. The following EPA staff also contributed significantly to the writing of the report and to the work in Baltimore: Ethel Brandt, Damon Brown, James Darr, Deb Forman, Matt Gillen, Todd Holderman, Reggie Harris, Dawn Ioven, Jim Murphy, Nhan Nguyen, Terry O'Bryan, and Van Shrieves.

Members of the Air Committee who contributed to the work in Baltimore are listed in appendix A. Not all members listed in this appendix participated in the review and approval of this report. The following members of the Air Committee members reviewed, commented on, and approved this report: Suzanne Bond, Pars Ramnarain, and William Paul, Maryland Department of Environment; Don Torres and Rubin Dagold, Baltimore City Health Department; Peter Conrad, Baltimore City Department of Planning; Dr. Michael Trush, Johns Hopkins School of Hygiene and Public Health; Rev. Richard Andrews and Ed Looker, community residents; Dave Mahler, Condea Vista; Rebecca Besson, Delta Chemical; Richard Montgomery, Phoenix Services; John Quinn, BGE; Steve Dyer, Grace Davison; and Charles Nardiello, Arundel Corporation.

Versar, Inc., under contract Nos. 68-W6-0023 and 68-W-99-041, assisted EPA in the work in Baltimore and in the preparation of the case study. The EPA Work Assignment Managers were Dave Lynch and Damon Brown. The Project Officers for these contracts were Tom Murray, Cathy Fehrenbacher, and Cathy Turner, respectively. Pat Wood and David Bottimore were Versar's Work Assignment Managers for the study. David Bottimore, Pat Wood, Amanjit Paintal, and De-Mei Meng contributed to the writing of the report. Supporting Versar staff included Teri Schaeffer, Maggie Wilson, Kelly O'Rourke, Tim Sletten, Bill Jones, and Jay Wind. Word processing, graphics, technical editing and logistics support were provided by Valerie Schwartz, Susan Perry, Sandy Paul, Jennifer Baker, Janeice Zeaman, and Kathy Kelly.

The following EPA staff reviewed drafts of the report and provided comments: Carole Braverman (Region 5), Rich Cook (OAR/OMS), Jeneva Craig (OAR/OAA), Lois Dicker (OPPT), Andrea Pfahles-Hutchens (OPPT), Elizabeth Margosches (OPPT), Lawrence Martin (ORD), Doris Maxwell (OAR/OAA), Deirdre Murphy (OAR/OAQPS), Paul Rasmussen (OAR), and Ed Weiler (OPPT).

A peer review of a draft of this document was conducted by Eastern Research Group (ERG) under Contract No. 68-W6-0022. Todd Holderman (EPA/OPPT) was the Work Assignment Manager, Carol Rawie (EPA/OPPT) was the Project Officer, and Linda Cooper was ERG's Task Manager. Six peer reviewers were selected on the basis of their expertise in air quality assessment, emissions modeling, and risk screening/assessment. The following experts served as peer reviewers of this report: Mr. Michael Callahan (EPA/NCEA), Dr. Gail Charnley (HealthRisk Strategies), Dr. Douglas Crawford-Brown (UNC/Chapel Hill), Dr. Amy D. Kyle (UC/Berkeley), Dr. Kenneth L. Mitchell (EPA/Region 4), and Dr. Ronald Wyzga (EPRI).

INTRODUCTION

Baltimore Case Study: Risk-Based Air Screening

- Southern Baltimore, Maryland
- Six-Step Risk-Based Air Screening Process Applied to 125 Sources and 175 Chemicals
- Identification of Chemicals of Concern
- Accomplishments and Limitations of Screening Effort

This Baltimore Case Study report describes the work and the results of a risk-based air screening project in Baltimore, Maryland. The report was prepared by technical support staff of the U.S. Environmental Protection Agency's Office of Pollution Prevention and Toxics (OPPT) and Versar, Inc., for the Air Committee of the Community Environmental Partnership (CEP), located in southern Baltimore City and northern Anne Arundel County, Maryland. The introduction to this case study report describes the CEP, the Air Committee, the risk-based screening methodology, and the accomplishments and limitations of the screening effort. Following the introduction are sections that present the application of the six air screening steps to the assessment of air pollution sources in southern Baltimore. These are followed by a summary of the results and lessons learned. The public report that was prepared to communicate the results of the study to the community is included in Appendix J. The results described in that report and this Baltimore Case Study report provide preliminary answers to questions raised by community members about the air quality in their neighborhoods.

This is a case study of the work as it was carried out in Baltimore. The screening methodology described in this report is a work in progress. During the course of the work and in the effort to summarize the work for this case study, the participants in this effort identified many areas for improvement. These are noted throughout the text and summarized in the section on lessons learned. In addition, the case study was reviewed by independent experts in a formal peer review process. Additional suggestions for improvement were developed from these reviews. A summary response to the peer review comments and the comments themselves can be found in the appendices. While recognizing the validity of the suggestion for improvements in the scope and methods of the Baltimore Study, the Partnership Air Committee is confident that the information provided to the community in this report is both significant and valid.

EPA technical staff of the Office of Pollution Prevention and Toxics are now using the suggestions for improvement from the participants and the peer reviewers to develop an improved screening methodology and a "how-to" manual to help communities interested in understanding and improving their air quality. This improved methodology and manual will be available in the spring of 2000. For further information on this work or this case study, please contact the Community Assistance Technical Team of the Office of Pollution Prevention and Toxics. See contact information in the box at end of the Introduction (page 10).

The Community Environmental Partnership

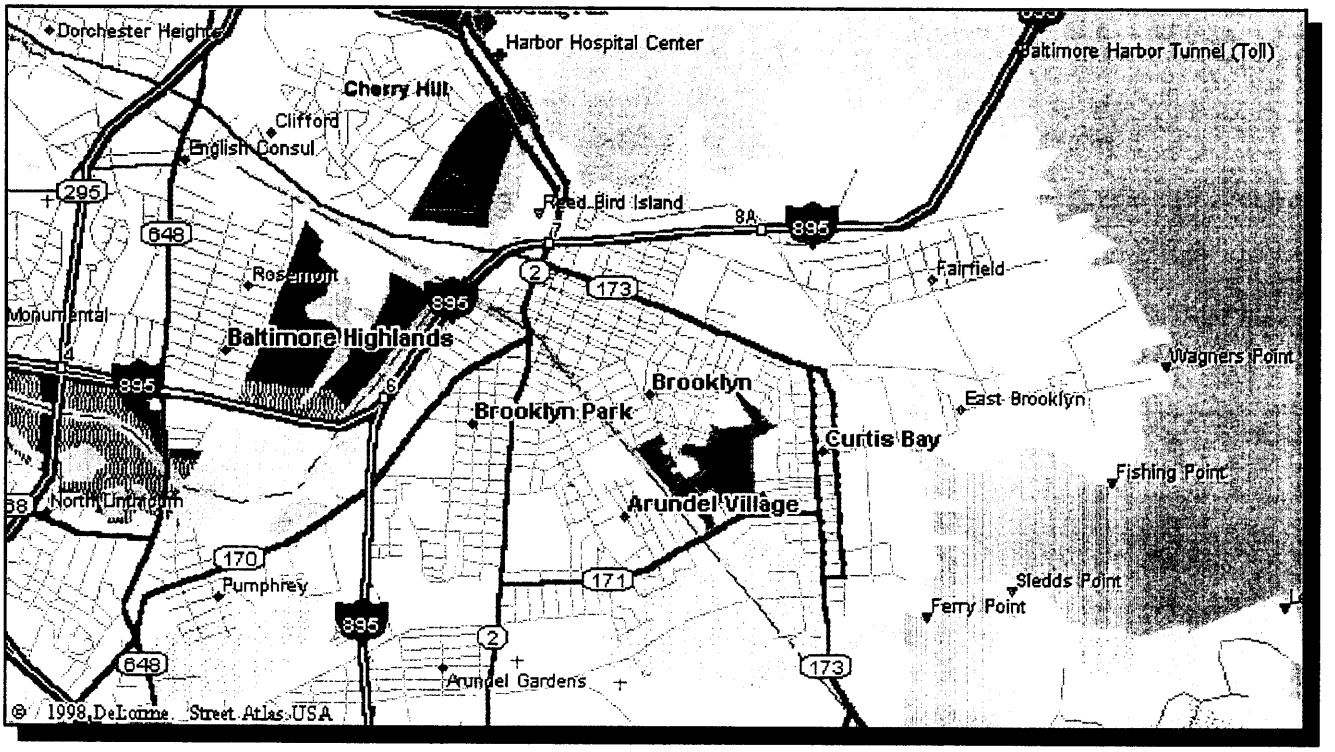
On May 3, 1996, the residents, businesses, and organizations of four Baltimore area neighborhoods—Brooklyn/Brooklyn Park, Cherry Hill, Curtis Bay, and Wagners Point—joined with local, State, and Federal government agencies in the Community Environmental Partnership (CEP) to begin a new effort to find ways to improve the local environment and economy. The five neighborhoods in the Partnership, with a combined population of about 30,000, are located in southern Baltimore City and northern Anne Arundel County (Figure 1). These neighborhoods have a broad range of environmental and economic concerns, including concerns that arise from the concentration of industrial, waste treatment and disposal, and brownfields sites located in and around the Partnership area. The area has great potential for the development of its environmental assets and its economy. The neighborhoods border the Chesapeake Bay and are the site for a new eco-industrial park, a major redevelopment effort that has the potential to attract new jobs. In this context, the Partnership set out to take a comprehensive look at the local economy and environment and to build consensus around a plan for action.

The Community Environmental Partnership started as a pilot for the new community-based approach to environmental protection and economic development.[1] This new approach is an effort to address environmental issues from the perspective of a neighborhood. It incorporates the local community's knowledge and allows for the consideration of a detailed level of information often missed when policy is made at the national or State level. The community-based approach changes the roles of the community and government: It empowers the community to take the lead in the decisions affecting their environment, and it puts government in the role of an adviser, providing the information and technical assistance not available in the community. Building consensus at the local level also makes it possible to unite the community around voluntary pollution prevention approaches that can go beyond current statutory requirements.

Community Environmental Partnership

- Community Residents
- Businesses
- Organizations (Local Schools and the Johns Hopkins School of Public Health)
- Local Government (Baltimore City and Anne Arundel County)
- State Government (Maryland Department of the Environment)
- Federal Government (U.S. EPA)

[1] See EPA's *Framework for Community-Based Environmental Protection*, U.S. EPA. February 1999. EPA 237-K-99-001 (U.S. EPA, 1999a).



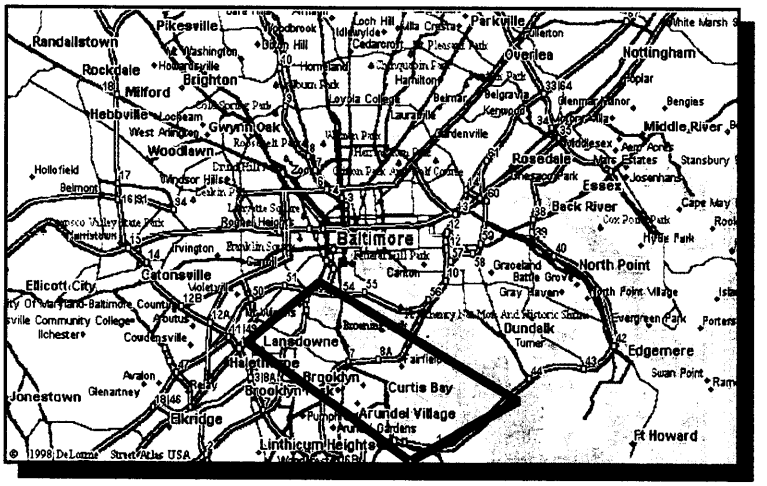


Figure 1. Case Study Area - Baltimore, Maryland

At the beginning of this effort, the partners agreed to focus on the following four goals:

1. Build the long-term capacity of the community, including residents and businesses, to take responsibility for their environment and economy,

2. Develop a comprehensive picture of the local environment and economy and an action agenda based on the needs and wants of the community,

3. Build consensus in the Partnership for the implementation of an action plan that makes a difference in the local environment and economy, and

4. Encourage and support sustainable economic development in the community.

As its first initiative, the CEP conducted a publicity campaign and, in July 1996, held a large public meeting to solicit public input and participation for the project. At this meeting, community residents and businesses discussed and voted on priorities for the Partnership. Five areas were identified as community priorities: (1) air quality; (2) trash, illegal dumping, and abandoned housing; (3) economic development; (4) parks and surface water quality; and (5) community health. Committees were formed to address each of these priorities. This report details the work of the CEP Air Committee. The John Snow Institute is currently preparing a separate report on the overall work of the CEP.

Environmental Setting

Community Key Issues of Concern

- Air Quality
- Trash, Illegal Dumping, and Abandoned Housing
- Economic Development
- Parks and Surface Water Quality
- Community Health

The case study area of southern Baltimore is an industrialized area with a large concentration of industrial, commercial, and waste treatment and disposal facilities. Among these are 11 facilities reporting air emissions to the U.S. Environmental Protection Agency (EPA) Toxics Release Inventory (TRI). Major facilities include an agricultural chemicals manufacturer, other chemical manufacturers, petroleum storage facilities, a medical waste incinerator, the city landfill, and a municipal wastewater treatment plant (publicly owned treatment works [POTW]). Additional facilities, including the city waste incinerator, a large steel mill, and two utility power plants, are located in neighborhoods located close to the Partnership area. More than 175 chemicals are emitted from the facilities in and around the Partnership neighborhoods, such as volatile organic chemicals (VOCs), metals, and others. About 30,000 people reside in the five Partnership neighborhoods of Cherry Hill, Brooklyn, Brooklyn Park, Curtis Bay, and Wagners Point.

The Partnership Air Committee and Goals

Air quality ranked first in the list of concerns voted on at the community's priority-setting meeting. The high interest in air quality was an indication of widespread community concern for the health of residents living in the Partnership neighborhoods and for the possible contribution of outdoor air pollution to the community's health. Community residents were particularly concerned about the possible consequences of the combined emissions from all the industrial, commercial, and waste treatment and disposal facilities located in and around their neighborhoods (See a full description of the pollution sources covered in the Emissions Inventory section on page 19.). In response to community concerns, the CEP Air Committee focused its work primarily on the contribution of air emissions from these types of point and area sources to outdoor air. Although some of the government partners raised the issue of indoor air quality as a topic for consideration, the community did not choose to make this a priority for the CEP Air Committee at that time.

To meet community concerns, the Air Committee set two overall goals for its work: (1) to determine if current levels of toxics in the air in Partnership neighborhoods resulting from the multiple industrial, commercial, and waste treatment and disposal facilities in and around the Partnership area may affect community health; and (2) to recommend actions to improve community air quality. The Committee focused on voluntary participation and voluntary action on the part of its members, with the aim of going beyond regulatory requirements where possible. Compliance, enforcement, and regulatory reform were not the focus for the Air Committee's work. The Committee's work was also done with the view of building the long-term capability of the community to understand and address air quality issues. (See additional discussion of the Air Committee's goals on page 14.)

Goals of Air Committee

- To Determine if the Current Aggregate Levels of Toxics in the Air Resulting from the Multiple Industrial, Commercial, and Waste Treatment and Disposal Facilities in and Around the Partnership Area May Affect Community Health
- To Recommend Actions To Improve Community Air Quality

Air Committee Meetings and Work

The Air Committee held its first meeting in September 1996, and it has continued to meet monthly since that time. Air Committee meetings have consistently drawn around 20 participants. Representation of different sectors of the community on the committee was fairly balanced for most of the Committee's work. Co-chairs, one industry representative and one resident, were elected to lead the Committee work. Four or five residents, one representative of an environmental organization, a faculty member of a local university, six or seven government

representatives, and six or seven business representatives attended the meetings regularly. (See list of Committee participants in Appendix A.) All Committee decisions were made by consensus, and special efforts were made to provide background information and education to ensure full participation by all Committee members. Facilitators were not used to help with the meetings. (During the summer of 1998, after the completion of the screening project but before the release of the results to the public, most community residents and the representative of the environmental organization left this committee. After their departure, the Committee relied on the Partnership's Executive Committee for community representation and direction to complete its work. (See the John Snow Institute case study for a more detailed discussion of the community participation in the Partnership. See also the letters exchanged between the environmental organizations and the Partnership in the summer of 1998 in Appendix B.)

The Baltimore Air Committee began its work by discussing air concerns, conducting an odor survey, and reviewing a report on local TRI releases. The Committee also invited a dioxin expert from EPA to give a presentation. After several months of background preparation, the Committee discussed and agreed on a method to conduct the air screening methodology described in the following pages.

Overview of the Community Air Screening Methodology

As the Air Committee began its work, it soon recognized that to answer community questions about air quality, it would need to find a way to evaluate more than 175 chemicals emitted to the air by more than 125 facilities in or around the Partnership neighborhoods. To complete this review, the Committee decided to develop a risk-based screening methodology that could help to set community priorities. The screening process uses standard methods to provide information on the potential health risks associated with chemicals in the air in Partnership neighborhoods. These methods are consistent with EPA's general guidance on conducting exposure and risk assessments (U.S.EPA, 1989; 1992a). The screening process also builds on established procedures for modeling human health risks from air pollutants, such as *A Tiered Modeling Approach for Assessing the Risks Due to Sources of Hazardous Air Pollutants* (U.S. EPA, 1992b). Using a risk-based approach helps to identify those chemicals that may pose the greatest risks by considering the many factors that influence the potential human health impacts from air pollution sources. For example, the methodology considers factors such as the type of chemical emitted, the quantity emitted, the distance from source to receptors (residents), local wind patterns, and the varying toxicity of the different chemicals.

Air Screening Methodology

- Step 1: Formed Partnership, Clarified Goals
- Step 2: Built Source Inventory Database
- Step 3: Conducted Initial Screening
- Step 4: Conducted Secondary Screening
- Step 5: Conducted Final Screening
- Step 6: Developed Public Report and Recommendations

The Air Committee did not begin its screening work with a completed plan for this methodology in mind. Rather, the Air Committee developed the methodology in a step-by-step fashion in response to the need at each stage of the work. This allowed the screening methodology to be developed in a way that would enable participants to tailor it to the particular needs of the study area. The Air Committee was able to exchange information with similar air inventory and risk assessment projects under way in other EPA offices, such as the Chicago Cumulative Risk Initiative (U.S. EPA, 1999b), the Cumulative Exposure Project (U.S. EPA, 1999c), and the Urban Air Toxics program (U.S. EPA, 1999d). These projects have similar goals of trying to determine exposures and risks from hazardous air pollutants, but they differ from this effort in scope. The methodology described in this report (for the Baltimore area) is still a work in progress. Lessons learned from the experience and areas identified for improvement are provided in the final section of the report. The development and the implementation of the screening work drew on the resources of all Committee members.

To develop a practical screening methodology that could be implemented with limited resources, the Committee used a multistep process. The initial screening used readily available information and simple and protective risk calculations to review the 175 chemicals. In each succeeding step, as the number of chemicals remaining in the screening process decreased, the Committee was able to use more detailed information and more accurate and resource-intensive methods of analysis.

Overall, the Committee's work in Baltimore can be divided into the six steps briefly described below. (See Figure 2 at the end of the introductory section for a flow chart of the air screening methodology.) A more detailed discussion of these steps as they were implemented in Baltimore is provided in the remainder of this report.

- Step 1: Formed Partnership, Clarified Goals

  Formed a broad Partnership committee with representatives from all sectors of the community, including community residents, local businesses, organizations, schools and universities, and local, State, and Federal government agencies. Clarified the goals of the Partnership and developed a plan for work. Also developed an outreach plan to facilitate communication with the community.

- Step 2: Built Source Inventory Database

  Created a community-specific inventory of industrial, commercial, and waste treatment and disposal facility air pollution sources from information available from sources such as emissions permits, compliance records, and the Toxics Release Inventory (TRI). Collected ambient air monitoring data for toxics from stations located in and around the Partnership neighborhoods. Entered these data into a database to facilitate screening.

- Step 3: Conducted Initial Screening

  Screened the inventory using toxicity data and a protective calculation of exposure to identify the chemicals needing further analysis.

- Step 4: Conducted Secondary Screening

  Used computer air dispersion modeling and local meteorological information to get a better estimate of the ambient concentrations for the chemicals selected in the initial screening (Step 3). Compared both modeling and monitoring results to health-based screening values chosen by the Committee. Chemicals with neighborhood concentrations higher than the screening values were identified for further analysis.

- Step 5: Conducted Final Screening

  Contacted the facilities to obtain the most accurate information available on emissions of the targeted chemicals and data pertinent to air dispersion modeling. Conducted the air dispersion modeling again using the refined information. Compared the resulting estimated airborne concentrations and/or monitored air concentrations to the screening guidelines. Chemicals exceeding the Committee screening values were identified as priorities for the community.

- Step 6: Developed Public Report and Recommendations

  Developed recommendations for improving air quality based on the results of the screening exercise and developed a report communicating the results and the recommendations to the community.

Understanding What the Baltimore Risk-Based Screening Effort *Could* and *Could Not* Accomplish

It is important to note up front what the results of the screening analysis could and could not provide to the community. The screening provided valuable information to the community and ***did*** accomplish the following:

- The analysis *did identify and inventory* all the significant commercial, industrial, and waste treatment and disposal sources of toxics in outdoor air in and around the Partnership neighborhoods.

- It *did provide* the best estimates available on the types and amounts of toxics in outdoor air in Partnership neighborhoods from facility sources, including estimates of the aggregate concentrations of the same chemical from multiple sources.

- It *did compare* estimated and measured concentrations to health values and provide enough risk information to help the community set priorities and chart an effective course of action for improving air quality.

- It *did help* to establish a community air quality baseline that can be used to evaluate future progress and to identify potential concerns with new sources.

- It *did allow* the Partnership to compare the levels in its neighborhoods to other urban neighborhoods where concentrations of the same chemical have been measured.

- The collaborative work *did help* to build consensus in the community on air issues and it *did provide* education and information to build community capacity to understand and address air quality issues in the long term.

The information provided from the screening analysis had definite limitations. The screening ***could not*** accomplish the following:

- Most importantly, the analysis *could not* establish the cause of current instances of diseases in the community. Chronic illnesses related to environmental causes may be, in part, due to exposures that occurred many years in the past. This analysis assessed current air quality and, consequently, it provided information on illnesses that could possibly occur in the future, not illnesses that are a result of past exposures. Also, many non-environmental factors that may influence community health were not a part of this analysis. These include factors such as diet, smoking, access to medical care, lifestyle, and genetics. All of these contributing factors need to be considered to effectively address community health concerns.

- Except in some limited cases, this type of screening analysis *could not* provide information on the possible effects of the combined mixture of different chemicals in the air. The science to understand the effects of mixtures of a large number of chemicals does not currently exist.

- The actual risk from these chemicals in each Partnership neighborhood *could not* be determined. This is because (1) much of the screening is based on estimates and not on actual measurement, (2) actual measurements were taken only in a limited number of locations in the Partnership neighborhoods, and (3) a study was not conducted for people living in the Partnership neighborhoods to accurately determine exposures. A detailed exposure study would consider, for example, time spent in the neighborhood, age, time spent outdoors, etc. To collect all information necessary for a more detailed risk analysis would cost more and take longer, and the Committee decided the additional information might not have contributed significantly to the community's ability to set priorities for improving air quality.

- The analysis *could not* provide a complete and comprehensive screen of the hazards associated with the 175 chemicals contained in the Baltimore inventory. Sixty-three of the 175 chemicals did not have readily available toxicity information and could not be included in the analysis. In addition, the toxicity information that was available may be incomplete. New testing, such as the testing for effects on children and for effects on endocrine systems, may identify additional hazards not considered in this analysis. Given the limits of toxicity information currently available, the Baltimore study is a review of known hazards, not all hazards.

- The analysis *could not* provide a complete picture of all aspects of air quality. Three aspects of air quality that may have significant chronic health effects were not a part of this study: ground level ozone, which is a by-product of the reaction of certain chemicals with sunlight; small particulate matter, especially from diesel exhaust; and short-term peak concentrations of certain chemicals that may contribute to health problems such as asthma. The Air Committee has recommended further work in these areas to evaluate their potential effects on the community.

Summary Flow Chart

Figure 2 contains a flow chart with a detailed outline for the six steps of the screening process. The details for each step are explained in the remaining sections of this report. See also the flow chart (Figure 7 on page 73) with modifications based on lessons learned from the Baltimore Case Study.

How to Contact the EPA/OPPT Community Assistance Team

Community Assistance Team
US Environmental Protection Agency
Office of Pollution Prevention and Toxics
Ariel Rios Building (7406)
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460
Telephone: 202-260-6750

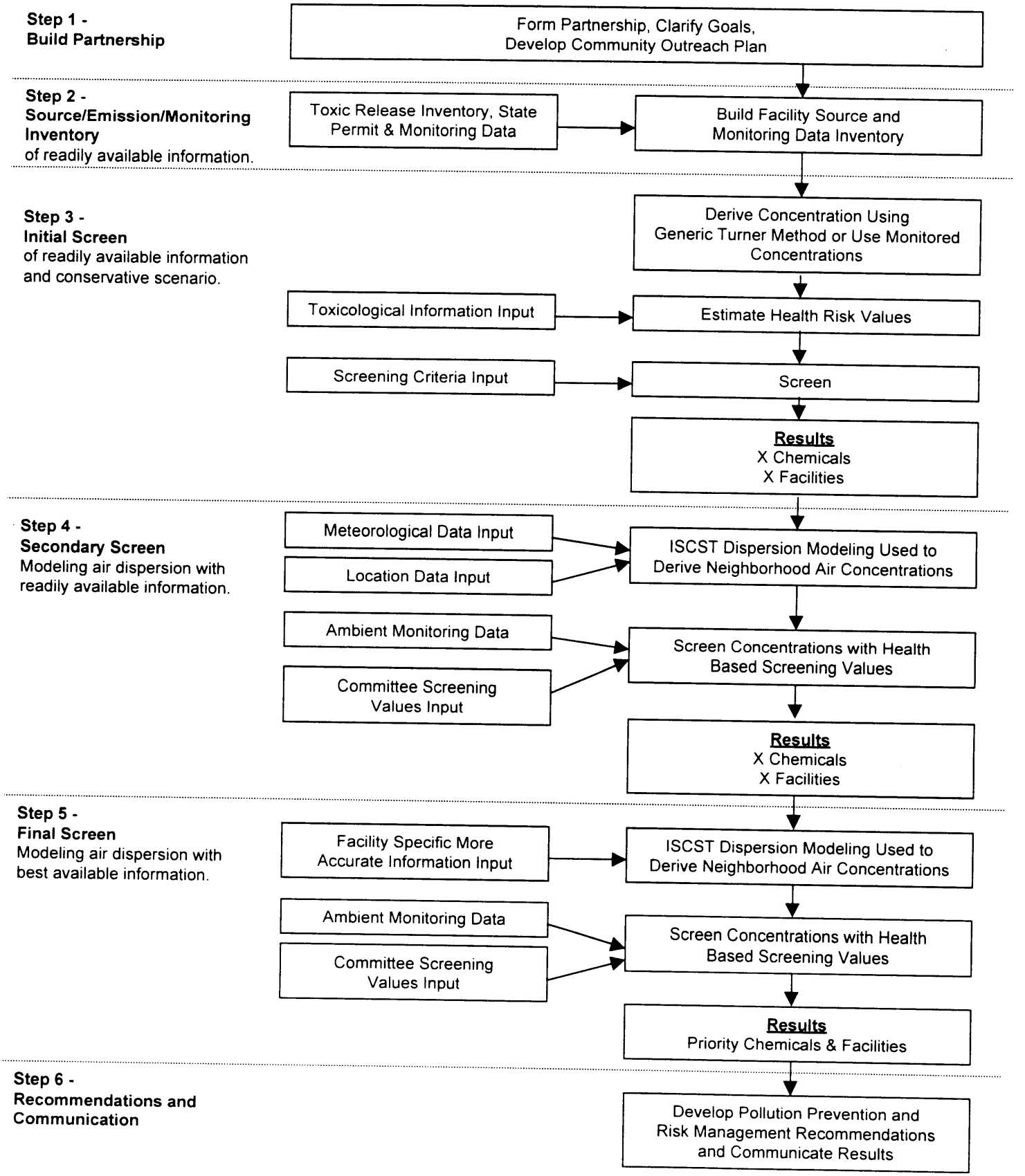


Figure 2. Flow Diagram for Air Screening Methodology

BUILD PARTNERSHIP (STEP 1)

Step 1 - Build Partnership	Form Partnership, Clarify Goals, Develop Community Outreach Plan

This section describes the first step of the air screening exercise carried out by the Air Committee of the Community Environmental Partnership (CEP) in the Baltimore area. Step One included building the Partnership to carry out the work, establishing Committee goals, and developing an outreach plan to communicate the Committee's work to the community.

Formed Partnership

The effort to build a working partnership to address the air quality and other environmental concerns of the neighborhoods of southern Baltimore and northern Anne Arundel County began in the spring of 1995. To form the Community Environmental Partnership, staff and managers from the EPA Office of Pollution Prevention and Toxics (OPPT) met with neighborhood residents, schools, churches, businesses, and local political representatives, including the neighborhood congressional representatives, as well as leaders and staff from the city and county, Maryland Department of the Environment, and EPA Region 3. More than 20 preliminary meetings and briefings were held to explain and consult on the goals and plans for the proposed Partnership. Many of these meetings focused on the question of the potential effect of the Partnership's work on already established efforts to address the concerns of the Partnership neighborhoods. To facilitate government coordination and cooperation in the Partnership, the government partners met biweekly for the first 2 years of the project.

Participants in Community Environmental Partnership

- Neighborhood Residents
- Neighborhood Organizations, Schools, and Churches
- Neighborhood Businesses
- Local Political Representatives, Including Congressional Representatives
- Area Colleges and Universities
- All Levels of Government: City, County, Maryland Department of the Environment, and EPA Region 3 and OPPT

Before the Partnership was established, a local group of businesses and the Baltimore Development Corporation both expressed special concerns. The businesses, represented by the

local Chemical Industry Council, were concerned that a new partnership might upset or duplicate the already established industry and neighborhood relationship. The Baltimore Development Corporation believed that the Partnership might interfere with the city's key brownfields redevelopment plans for an area within the Partnership boundaries. After these concerns were addressed, a consensus acceptable to all the participants was built around a sustainable development approach that considered jobs and a healthy environment. As a part of the consensus-building process, the Partnership visited 50 area businesses to introduce the project and to solicit their support. The positive response to these visits set the stage for the consensus needed for the Partnership. Following a year of discussions and as a culmination of the efforts to reach agreement, all of the partners met in the office of Baltimore's mayor on May 3, 1996, to officially launch the Community Environmental Partnership.

As described in the Introduction, the CEP organized five committees to address community priorities. Air quality was identified as the top priority. More than 60 people from all sectors of the community and all levels of the government participated actively in the work of these committees. Small companies and retail businesses worked primarily on the Economic Development Committee. Students and teachers from local schools and the largest number of residents worked on the Parks and Surface Water Quality and the Trash committees. These committees focused primarily on a project that identified an urban stream flowing into a cove on the Bay shoreline and initiated efforts to restore the stream and use the cove as a community wildlife preserve.

Partnership Priorities

- Air Quality
- Community Health
- Trash, Illegal Dumping, and Abandoned Housing
- Parks and Surface Water Quality
- Economic Development

The Air Committee, with approximately 20 participating members, was the largest committee in the Partnership. The Air Committee met monthly from September 1996 through completion of this report to the community. (A list of regular Air Committee members can be found in Appendix A.) In addition to its regular members, meetings usually drew several additional participants interested in or asked to address a current agenda item.

Clarified Air Committee Goals

The goals for the Air Committee were established in response to the community's concerns for air quality as expressed at the opening public meeting or by the community residents and business members of the Air Committee. The concerns expressed included the following:

- The possibility that the cumulative and aggregate effects of the chemical emissions from the concentration of industrial, commercial, and waste treatment and disposal facilities in and around the Partnership area may be contributing to poor community health, including the possibility that not enough attention was paid in the permitting process to the possible cumulative effects of emissions from multiple facilities. This concern about the possible contribution of emission sources to community health was the main concern expressed by the residents working in the Air Committee.

- The possibility that disease incidence in Partnership neighborhoods, especially the incidence of cancer, are higher than other areas of the city and county. The Health Committee, a separate Partnership committee, was organized to investigate this concern.

- The possibility that unreported emissions may exceed permit levels, especially during weekends or at night. This concern was exacerbated by the frequent occurrence of strong and unidentified odors in some Partnership neighborhoods.

- The possible disproportionate number of waste treatment and disposal facilities sited in the Partnership neighborhoods. Both residents and businesses felt that the reputation and the livability of the community were adversely affected by the large number of waste treatment and disposal facilities. The location of a regional medical waste treatment facility in the Partnership area was a special concern to some residents.

All of these concerns about community health and siting issues were heightened by Baltimore City's plans to focus its brownfields redevelopment efforts on a part of the Partnership area. While the city's plans to attract environmentally responsible companies for an eco-industrial park allayed some concerns, residents and businesses still had concerns about the location of new facilities in the area because the cumulative effects of existing facilities had not been adequately characterized.

In response to these community concerns, the Air Committee decided to focus on the main concern and adopted the following goals:

- To determine if the current aggregate levels of toxics in the air resulting from the multiple industrial, commercial, and waste treatment and disposal facilities in and around the Partnership area may affect community health, and

- To recommend actions to improve community air quality.

Clarified Air Committee Goals

- To Determine if the Current Aggregate Levels of Toxics in the Air Resulting from the Multiple Industrial, Commercial, and Waste Treatment and Disposal Facilities in and Around the Partnership Area May Affect Community Health
- To Recommend Actions To Improve Community Air Quality

The Air Committee's choice of goals narrowed the range of community concerns that would be addressed by the Committee. The Committee concluded that siting of waste treatment and disposal facilities was a local land use issues and not an appropriate issue for the Partnership Committee. In addition, the Committee's focus on potential exposures to toxic chemicals emitted by industrial, commercial, and waste treatment and disposal facilities meant that the Committee did not fully consider other types of potential exposures, including:

- Exposure to toxics from mobile sources, including particulate matter emissions from diesel truck traffic. (The Committee did analyze data from the State ambient air monitoring station located in the Partnership area. The monitored levels represented the aggregate concentrations from all sources including mobile sources. To help explain these monitored concentrations, the Committee estimated the contribution of mobile sources to the level of toxics in outdoor air. This estimation is described in Step 5);
- Exposures to toxics in indoor air; and
- Short-term and peak exposures that might produce acute effects.

The Committee's scope of work also did not include the consideration of additional factors, other than outdoor air toxics, that might affect community health, such as diet, access to medical care, exposure to lead paint, etc. The narrowing of the Committee's focus to an examination of facility emissions and their potential to affect community health was a conscious Committee choice. The choice was made to respond to the concern of some Committee members who felt that the inclusion of other sources of toxics would distract attention from the industrial, commercial, and waste treatment and disposal facility sources that they believed were the main community concern. In general, the Committee accepted this approach and decided that its work would have more credibility if it spoke directly to the main community concern.

The limited scope of the Air Committee's investigation eventually produced a dilemma. The Committee wanted to focus on the facility sources and to develop concrete recommendations to improve community health. However, the limited focus meant that when the Committee completed its work, it might not be in a position to identify the most effective actions to improve

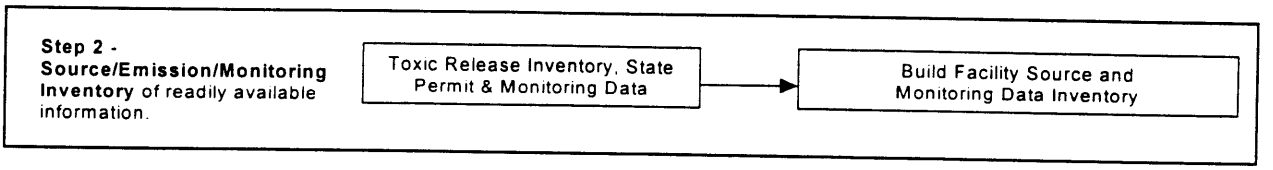
community health. This would be the case if a source of air pollution not included in the study, such as mobile sources, turned out to be a significant source for the community. In fact, when the results of the limited analysis of exposure to facility sources found that these sources were not likely to be a significant contributing factor to community chronic health concerns, the Committee did not have enough information about the other sources to develop the most effective recommendations. (See recommendations in the Air Committee Report, Appendix J.) The possible contradiction between the limited scope of the Committee's work and its ability to make recommendations for the improvement of community air quality and health was not adequately discussed, understood, and agreed to at the beginning of the work.

Developed Plan for Community Outreach

The Coordinating Committee of the CEP asked each of its committees to take 6 months to collect information, develop recommendations, and report back to the Partnership. While the Committee's work proceeded, the Partnership continued its overall outreach efforts. In May 1997, the Partnership opened a community storefront office with environmental information, Internet access, and meeting space. Baltimore Mayor Schmoke joined the community for the opening celebration. In addition, a monthly newsletter describing the progress of the various committees and Partnership was established and sent to more than 300 community members. During its first year, the Partnership organized community cleanups, several educational presentations, and a major Earth Day event.

On April 30, 1997, the Partnership organized its second large public meeting to give the five committees the opportunity to present their findings and recommendations to the community. The Air Committee was not able to complete its screening exercise in time for this meeting; therefore, the Committee presented preliminary results and committed to make a full report at a later date. The screening exercise was completed by the end of 1997. The Air Committee then focused on the production of a report (Appendix J) that could adequately explain and summarize its work for the community. (See discussion of the preparation of this report in Step 6.) Plans are now being made to organize meetings in the community to present and discuss this report.

EMISSIONS INVENTORY (STEP 2)



Overview

To begin its screening analysis, the Air Committee first collected all readily available information relating to local air quality, including information on facility releases and information on concentrations of toxic air pollutants measured at local monitoring stations. The emissions inventory was conducted over a 2-month period by a technical subgroup of the Air Committee, which consisted of representatives from EPA and the Maryland Department of the Environment (MDE). The inventory recorded information on the amounts of chemicals emitted into the air each year by facilities in and around the Partnership area. EPA and MDE reviewed the inventory periodically for completeness and accuracy. The subgroup used a computerized spreadsheet to compile and manage the extensive information.

Emissions and Monitoring Inventory

- Inventory of Emissions Data from 125 Facilities in Area
- Both Emissions Data and Ambient Air Monitoring Data Collected from MDE and U.S. EPA
- Data Organized and Managed Using Spreadsheet That Was Used for All Screening Steps

The emissions inventory included a wide variety of industrial, commercial, and waste treatment and disposal sources of air pollution,[2] ranging from small sources such as gas stations,

---

[2] Using the terminology of the Clean Air Act, both point (major stationary) and area (small stationary) sources were included in the emissions inventory for this project. Under the Clean Air Act , "point" or "major stationary" sources are stationary facilities that emit a regulated air pollutant in an amount exceeding the threshold level -- 100 or 250 tons per year -- depending on the pollutant and type of facility. Typical major stationary sources include large industrial complexes like power plants, chemical plants, oil refineries, and steel mills. "Area" sources are smaller stationary sources of pollution that are not inventoried individually but whose emissions are estimated as a group and reported as a single source category for a geographic area. Examples of "area sources" include gas stations, dry cleaners, consumer use of solvents, and gas furnaces, fireplaces, and woodstoves which are typically associated with homes and nonindustrial sources.

In the third step of the Baltimore project, air dispersion modeling was used to estimate airborne concentrations of chemicals of concern emitted from industrial, commercial, and waste treatment and disposal facilities. To avoid confusion over terminology, please note that the Clear Air Act definitions for point and area

(continued...)

with annual emissions to air of less than 100 pounds of chemicals, to large facilities with annual emissions of over 1 million pounds. As discussed in Step 1, mobile sources of air pollution such as vehicles, small engines (e.g., lawn mowers and other lawn equipment), combustion products from furnaces, fireplaces, and grills, and ozone and other pollutants emitted or formed in other regions and transported long distances to the Partnership area were not covered in the inventory. Table 1 presents a summary of the types of sources included (and not included) in the inventory for the Baltimore Case Study.

Once the decision was made on the types of facilities to include in the inventory, attention shifted to the process of building the source inventory and finding databases of emissions and monitoring data. This effort benefitted from the knowledge and experience of other EPA programs, such as the Cumulative Exposure Project and the Urban Air Toxics program (U.S. EPA, 1999c and d), as well as on electronic databases maintained by the EPA and MDE (described later in Step 2.)

Sources for Identifying Facilities

A number of information sources were used to identify specific facilities in the Partnership area and to quantify the annual emissions of individual chemicals. ZIP Codes 21225 and 21226 defined the Partnership area. Information was also gathered for facilities located within 5 miles of the Partnership area (ZIP Codes 21060, 21061, 21090, 21122, 21219, 21222, 21227, 21230). As a starting point, the subgroup included all businesses operating in the Partnership area that were listed by Dun & Bradstreet (D&B). Each business was listed by

South Baltimore Partnership Area/Neighborhoods

- ZIP Codes 21225, 21226
- Neighborhoods
  - Cherry Hill
  - Brooklyn/Brooklyn Park
  - Curtis Bay
  - Wagners Point

[2](...continued)

sources described above are not the same as those commonly used in air dispersion modeling. In air dispersion modeling, the terms point and area source have a meaning not related to the amount of the emissions. Point sources have an exact emission site, such as an exhaust stack and they can be both large and small. Area sources, in contrast, cannot be associated with an exact emission site. Area source emissions may come, for example, from evaporation over a large area or from leakage from small multiple locations such as valves. In air dispersion modeling, sources, both large and small, with emissions dispersed across the site are called area sources. Emissions from these sites are modeled as though they were uniformly emitted from the entire area covered by the site. Under the Clean Air Act, all small sources are called area sources regardless of whether their emissions come from an exact point or are dispersed across a site. Thus a small business with an exhaust stack is an area source under the Clean Air Act and a point source in the terminology of air dispersion modeling. Similarly a large source with dispersed emissions, such as a waste treatment facility, would be called a point source under the Clear Air Act and an area source for purposes of air dispersion modeling. Understanding the different use of these terms will be helpful when air dispersion modeling is discussed in step three of the screening methodology.

Table 1. Sources Included and Not Included in the Inventory for the Baltimore Case Study

CAA Category	Included in Baltimore Inventory	Not Included in Baltimore Inventory
Point (major stationary) Examples: chemical plants, power plants, incinerators, landfills, steel mills, POTWs	X	
Area (small stationary) (a) Commercial and industrial chemical use and handling Examples: dry cleaners, gasoline stations, print shops	X	
(b) Commercial, industrial, institutional boilers Examples: schools, hospitals, office building heating		X
(c) Household heating and chemical use Examples: furnaces, fireplaces, lawn chemicals		X
Mobile Sources (a) On road Examples: cars, trucks, buses		X
(b) Off road Examples: portable generators, construction equipment, boats, lawn mower		X

name, type of business, address, telephone number, number of employees, and standard industrial classification (SIC) code (U.S. EPA, 1997a). The subgroup compared this list against a list of facilities permitted by the State of Maryland to emit chemicals to the air, provided by the MDE Air and Radiation Management Administration (ARMA). The list of permitted facilities and the EPA Toxics Release Inventory (TRI) were used to make a master list of facilities that might emit chemicals into the air. The list was then reviewed by:

- Partnership members, including residents familiar with businesses operating in their neighborhoods;
- Chemical engineers familiar with the types of businesses and activities that emit chemicals to the air; and
- MDE staff who were aware of the facilities no longer in operation or whose permits had changed.

Once the final list of facilities operating in and around the Partnership area was obtained, emissions data in pounds per year (lb/yr) were collected and entered in the inventory database. A list of 125 potential facilities was created in this step.

Sources Used To Collect Emissions and Ambient Air Monitoring Data

A variety of database sources were used in compiling the inventory for southern Baltimore. Various government agencies, at local, State, and Federal levels, maintain these databases as part of their compliance monitoring systems. The Air Committee accessed pertinent data sources to obtain data on emissions and concentrations of chemicals in ambient air. The data sources from MDE and EPA are described below. Appendix F contains examples and information on accessing these data sources on the Internet.

Emission Inventory Databases

- Dun & Bradstreet List of Businesses
- Maryland Department of the Environment
  - Registered Stationary Source Emissions
  - Toxic Air Pollutant (TAP) Emissions
- EPA
  - Toxics Release Inventory (TRI)
  - Facility Index System (FINDS)
  - Aerometric Information Retrieval System Facility Subsystem (AIRS/AFS)

Maryland Department of the Environment, Air and Radiation Management Administration

Registered Stationary Source Emissions

Registered source data were provided by MDE. Facilities that are major sources of volatile organic compounds (VOCs), sulfur oxides (SO_x), and nitrogen oxides (NO_x) and facilities with permits to operate were

included in the registered sources emissions inventory. These facilities are required to provide annual emissions data for selected chemicals to the MDE. The chemical emissions reported include certain air toxics and criteria air pollutants (e.g., SO_x, NO_x, particulate matter).

MDE data were later identified by the type of emission (e.g., stack—controlled emissions through an elevated exhaust stack; or fugitive—uncontrolled emissions from leaks and evaporation often near the ground) by EPA and MDE's Air and Radiation Management Administration. These emissions data were entered into a computerized spreadsheet for easier organization and use.

Toxic Air Pollutant (TAP) Emissions

MDE provided TAP emissions data for the most recent year available (1995). MDE collects these data because the State of Maryland developed air toxics regulations for emissions of TAPs not addressed by national or State ambient air quality standards. Carcinogens are "Class I TAPs," and other toxics are "Class II TAPs." Regulations are applicable to any source required to have an air quality permit that discharges a TAP. New construction sources may be required to report TAP emissions, and the source must provide a statement every year that certifies current compliance. A list of TAP chemicals and an example of TAP emissions data for the Partnership area ZIP Codes are included in Appendix F.

Ambient Air Monitoring Data

MDE operates an air monitoring network throughout the State in accordance with EPA guidelines to measure the concentrations of criteria pollutants and selected air toxics in the ambient air. This ambient air monitoring data could be used to represent the concentrations of chemicals in the air that the neighborhood residents breathe. One monitoring station is located in the Partnership area (Fairfield monitoring station). This area is a predominantly industrial zone with significant emissions from chemical manufacturing and petrochemical storage facilities. Five other monitoring sites are located in the Baltimore area (Glen Burnie, Downtown Baltimore, Fort McHenry, Essex, and Northeast Baltimore). The Fairfield monitor, as well as other monitors, are positioned so as to provide readings suitable for estimating exposure over a larger geographic area.

Ambient Air Monitoring Data

- Maryland Department of the Environment
- Ambient Air Monitoring Data for 41 Chemicals from 1992 through 1996
- Five Baltimore Area Monitoring Stations
- Fairfield Monitoring Station Located in Partnership Area
- Use of 1996 Average Concentrations for Risk Screening

Data from 1992 to 1996 for the 41 chemicals monitored, along with their Chemical Abstract Registry (CAS) numbers and details of the MDE monitoring program, are presented in Appendix F. The ambient air monitoring data from the five Baltimore area monitoring stations were compared to the monitoring station in the Partnership area to determine if Partnership area concentrations were significantly higher than other areas around Baltimore. A comparison of the monitored concentrations at the five monitoring sites in the Baltimore area for 1996 is provided in Appendix J.

The trends in air pollutant concentrations for most of the monitored pollutants were steady or downward between 1992 and 1996. In order to use information most relevant to the current levels of chemicals in the air, the Air Committee decided to use monitoring data from 1996 in the screening exercise. Furthermore, annual average concentrations were used for screening because use of maximum values would have probably been too conservative since they were not typical of air quality.

U.S. Environmental Protection Agency (EPA)

Toxics Release Inventory (TRI) Data

EPA collects multimedia chemical release data from selected manufacturing and waste management facilities in the United States (U.S. EPA, 1997b). Certain types of businesses are required to report to EPA on the use and release of about 650 toxic chemicals. The data are compiled in the TRI and are publicly available for use by communities to identify those facilities that release toxic chemicals into the air, water, and other media. Air emissions data, representing both stack and fugitive air emissions estimates, were retrieved from TRI for ZIP Codes 21225 and 21226 (U.S. EPA, 1997b). TRI data for 1994 through 1996 were used when State data were not available. An example of TRI data is shown in Appendix F.

EPA Websites for Air Emissions Data

EPA's Envirofacts Database provides access to several EPA databases that provide users with information about environmental releases to air in the United States. Data sources used for this project included:

- Envirofacts Database: http://www.epa.gov/enviro/index_java.html
- Toxics Release Inventory (TRI): http://www.epa.gov/enviro/html/tris
- AIRS/AFS: http://www.epa.gov/enviro/html/air.html

Aerometric Information Retrieval System Facility Subsystem (AIRS/AFS) Data

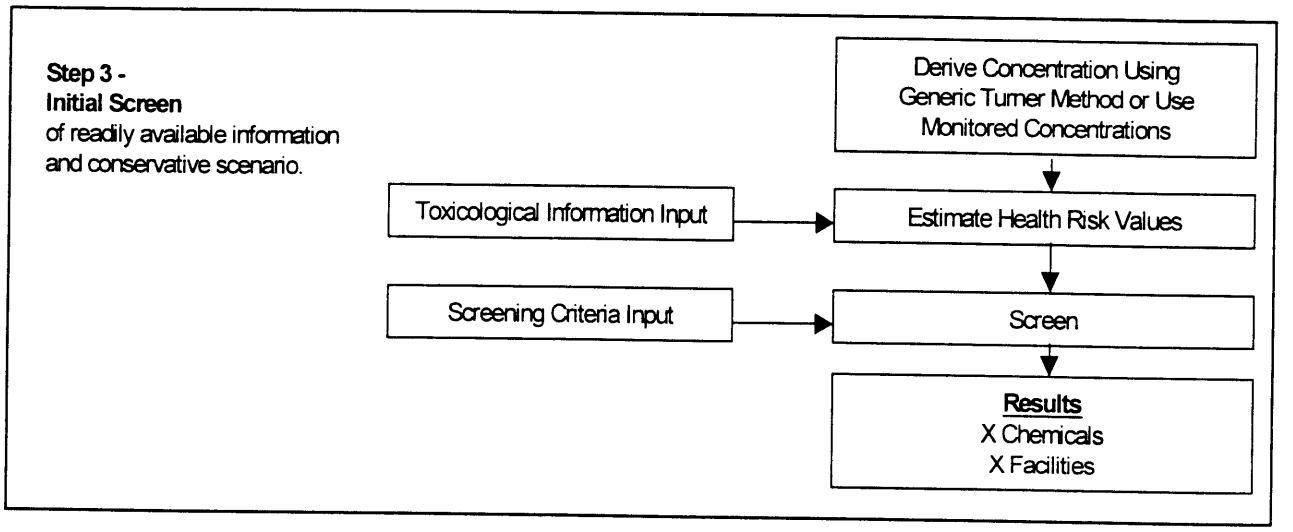
The Aerometric Information Retrieval System Facility Subsystem (AIRS/AFS) contains emissions and compliance data on air pollution point sources regulated by the EPA and/or State

and local air regulatory agencies under the Clean Air Act. AIRS/AFS contains data on industrial facilities, power plants, and similar sources. In general, emissions data are provided for criteria air pollutants (sulfur oxides, nitrogen oxides, particulate matter, carbon monoxide, volatile organic compounds, and lead) and select hazardous air pollutants. Data available for the screening typically represented emissions from inventories conducted in 1995 (U.S. EPA, 1997c).

Database Management

In order to effectively store, manage, and use the data collected, a spreadsheet was created using readily available commercial software (Lotus and Excel). Each database record consisted of a chemical, a facility, an annual emission rate (from the MDE TAP data and from TRI), and other information necessary to calculate exposures and risks. The records also included information such as latitude and longitude of the facilities, emission type (stack or fugitive), stack description, cancer slope factors, and reference doses. (An example of the columns of the database is provided in Appendix G.) Data entry was performed by a number of individuals working on the technical subgroup, and entries were generally checked for errors at least three times. Source documents (hard copy) from which the data were extracted were also maintained as backup for the electronic files.

INITIAL SCREEN (STEP 3)



Overview

Initial Screen

- Use of Source Emissions Data and Generic Turner Method to Predict Air Concentrations
- Estimate of Potential Risk from Inhalation of Chemicals at Predicted Ambient Concentrations
- Comparison of Estimated Risk Against Screening Values
- Identification of 29 Chemicals of Concern

This section describes the application of the initial screening step to emissions sources and monitored concentrations of toxic air pollutants in southern Baltimore. With information on 175 chemicals and 125 facilities assembled in the source inventory database, the Air Committee needed to develop a method to identify which chemicals, if any, might be of concern to the community.

To begin the screening process, the Committee first needed a method to estimate the ambient air concentrations in Partnership neighborhoods that resulted from all the emissions reported in the source inventory. With the large number of chemicals and facilities needing review, the Committee decided that using computer air dispersion modeling to estimate concentrations at this step would require considerable resources. Instead, for the initial screen, the Committee used a simple and protective calculation, described in detail below, to estimate air concentrations. The Committee also included ambient air concentrations measured at the area monitoring station in this initial screen. These estimated and measured ambient air concentrations (concentrations were estimated for 175 chemicals, which included monitored concentrations for 41) were then used to develop

very protective estimates of potential risks to human health from inhalation of these chemicals. The risk estimates for each chemical were then compared to a human health risk-based screening value chosen by the Committee. Any chemicals with risk estimates above the Committee screening value were identified as being of potential concern and were kept in the process for further review. Chemicals with risk estimates below the Committee screening value were eliminated from the screening process. A total of 29 of the 175 chemicals were identified from the initial screen for further review. Details of the process and results are described below.

The Committee designed this initial screening step using conservative assumptions about exposure (i.e., assumptions that tend to overestimate exposure) to make sure that any chemicals that might be of concern were identified for further review. Using conservative assumptions also meant that the Committee could not assume that the chemicals flagged in the initial screen presented a significant risk to the community. More accurate and realistic information was needed to further evaluate potential risks from exposures to these chemicals; therefore, these chemicals were "promoted" to secondary screening where more accurate exposure concentration estimates were developed for risk screening.

Initial Screen Procedures

To complete the initial screen, the Committee entered all information needed to get a screening-level estimate of exposure and risk into the source inventory database. Toxicity information on each chemical was collected and added to the source emissions and monitoring information collected in Step 1. Formulas for calculating conservative ambient air concentrations, exposures, and risks for each chemical were then added to the database, and the calculations were made. The Committee then chose a screening value and compared the calculated risk to the screening value to identify the chemicals that needed further evaluation.[3]

Input from all the Committee members was used to complete this step. Citizens and local businesses verified the accuracy of the source inventory as it was entered into the database. The full Committee participated in the discussion and decision on the choice of screening values and recommended chemicals for further evaluation that were of significant concern to the community for reasons other than the exposure or risk calculations. Government partners provided the air emissions information. Technical experts on the committee assisted with collection of toxicity information, management of the database, and calculations of exposure and risk for the Committee's review. The database was designed to be located in the community so that it could be viewed and updated annually (or more often if warranted).

---

[3] If risk-based concentrations (RBCs) for the chemicals are available, the estimated air concentrations can be compared directly to the RBCs. This eliminates the need for the risk calculations. For the first step of the screening, the Air Committee did not have access to RBCs. For subsequent steps of the process, described in Steps 4 and 5, the Committee used EPA Region 3 RBCs (U.S. EPA, 1997d).

Technical aspects of the initial screening were designed and carried out in a series of meetings by a subgroup of the Partnership Air Committee. Technical staff from the Johns Hopkins School of Public Health, industry, EPA, and MDE formed the technical subgroup. The subgroup included technical staff with expertise in toxicology, exposure modeling, and risk analysis. EPA provided information on the toxicity of the chemicals in the source inventory, and other Committee members reviewed the information. Building on the source inventory database developed in Step 2, EPA staff added the exposure and risk calculations to the spreadsheet for the screening exercise.

The technical subgroup then held a screening meeting, where chemicals were either dropped or selected for further review. For this review, the spreadsheet was used to sort the inventory by chemical, risk, and quantity emitted. Using this information, Committee members agreed by consensus which chemicals to eliminate from further review and which to move forward for more detailed review in the secondary screening. The actual decision meeting lasted more than 5 hours. Although the meeting was open to all Committee members, community residents did not attend this screening meeting. Residents reviewed the process and results at the next full Air Committee meeting.

Background information on risk screening and additional information on the dose and risk calculations used in the initial screening step are provided below. In this risk screening methodology, the initial screening step developed by the Committee is divided into five separate substeps: (1) collection of toxicity information, (2) estimation of ambient concentrations and potential doses, (3) calculation of cancer risk estimates and hazard quotients, (4) selection of screening values, and (5) comparison of calculated risks and hazard quotients to screening values. These steps are described below following presentation of information on risk screening.

Background Information on Risk Screening

The screening method used by the Air Committee follows the basic risk assessment paradigm developed by the National Research Council (1983):

1. *Hazard identification* is the process of determining whether exposure to a

Risks and Hazards

How estimates of hazard and risk are expressed depends on the nature of the hazard and the types of data upon which the assessment is based. For example, cancer risks are most often expressed as the increased probability of developing cancer for an individual exposed to the chemical in question (i.e., 1 in 1,000,000 or 10^{-6}). Risk estimates for adverse effects other than cancer are usually expressed as the ratio of an estimated dose or exposure level to a toxicologic potency value. This is known as a hazard quotient. A key distinction between cancer and other toxicologic effects is that most carcinogens are assumed to have no dose threshold (i.e., no dose or exposure level can be presumed to be without some risk). Other toxicologic effects are generally assumed to have a dose threshold (i.e., a dose or exposure level below which adverse effects are not expected). But there are exceptions. For example, some carcinogens have thresholds.

chemical can cause an adverse health effect and whether the adverse health effect is likely to occur in humans.

2. *Dose-response assessment* is the process of defining the relationship between the dose of a chemical received and the incidence of adverse health effects in the exposed population. From the quantitative dose-response relationship, toxicity values are derived that are used in the risk characterization step to estimate the likelihood of adverse effects occurring in humans at different exposure levels.

3. *Exposure assessment* identifies populations exposed to a chemical, describes their composition and size, and presents the types, magnitudes, frequencies, and durations of exposure to the chemical.

4. *Risk characterization* integrates hazard and exposure information into quantitative and qualitative expressions of risk. A risk characterization includes a description of the assumptions, scientific judgments, and uncertainties embodied in the assessment.

Cancer Risk Assessment

Assessment of cancer risks was conducted in a manner that was consistent with EPA's cancer assessment guidelines (U.S. EPA, 1996) and guidance documents such as *Risk Assessment Guidelines for Superfund* (U.S. EPA, 1989). The National Toxicology Program publishes the *Annual Report on Carcinogens* (DHHS, 1994) mandated by the Public Health Service Act. This report lists chemicals "known to be carcinogenic" and chemicals "which may reasonably be anticipated to be carcinogens." Research and regulatory organizations typically employ a "weight-of-evidence" approach to determine the likelihood that a chemical is a human carcinogen. Each chemical evaluated is placed into defined weight-of-evidence categories. For example, EPA (1997e) classifies carcinogens by the five categories listed below[4].

- Group A — human carcinogen
- Group B — probable human carcinogen (B1 indicates limited human evidence; B2 indicates sufficient evidence in animals and inadequate or no evidence in humans)
- Group C — possible human carcinogen
- Group D — not classifiable as to human carcinogenicity
- Group E — evidence of noncarcinogenicity for humans

[4] EPA's guidelines for cancer risk assessment are currently undergoing revision. The proposed guidelines recommend significant changes in the way weight-of-evidence and potency determinations are conducted and expressed. The proposed guidelines emphasize the importance of evaluating the mode of action in the assessment of potential carcinogens.

The International Agency for Research on Cancer (IARC) uses a similar classification scheme:

- Group 1 — carcinogenic to humans;
- Group 2A — probably carcinogenic to humans;
- Group 2B — possibly carcinogenic to humans;
- Group 3 — not classifiable as to carcinogenicity; and
- Group 4 — probably not carcinogenic to humans.

When the available data are sufficient for quantification, estimates of a chemical's carcinogenic potency can be developed. For example, EPA "slope factors" express carcinogenic potency in terms of the estimated upper-bound incremental lifetime risk per milligram per kilogram (mg/kg) average daily dose (U.S. EPA, 1997e). Cancer slope factors (CSFs) are available, where applicable, for both oral (SF_o) and inhalation (SF_i) exposures. "Unit risk" is a similar measure of cancer potency for air or drinking water concentrations and is expressed as risk per microgram per cubic meter ($\mu g/m^3$) in air or as risk per microgram per liter ($\mu g/L$) in water for continuous lifetime exposures.[5] The term "upper bound" in this context means that the measures of cancer potency are high-end estimates, so they will be conservative. This may result in an overestimate of cancer risk when toxicity data are incomplete, which is usually the case. The upper-bound value is intended to be protective of human health for continuous lifetime exposures, even though cancer risk may be overestimated. The use of the average or lower limit values would be more likely to underestimate cancer risk.

Cancer risk is calculated by multiplying the estimated dose by the appropriate measure of carcinogenic potency, the cancer slope factor. For example, an individual with a lifetime average daily dose of 0.03 mg/kg-day of a carcinogen with cancer slope factor of 0.02 $(mg/kg\text{-}day)^{-1}$ would experience an increased lifetime cancer risk of 0.0006 (also expressed as $6 * 10^{-4}$ or 6E-04) from exposure to that chemical. Similarly, cancer risk could be calculated using an air concentration multiplied by the unit risk factor. In general, risks from exposures to more than one carcinogen are assumed to be additive, unless information on interactions points toward a different interpretation.

Risk Assessment for Other Chronic Health Effects

Because adverse effects other than cancer and gene mutations are generally assumed to have a dose or exposure threshold, a different approach is needed to evaluate toxicologic potency and risk for these "systemic effects." The approach for assessing noncancer effects was consistent with EPA's guidelines (U.S. EPA, 1989). "Systemic toxicity" means an adverse effect

[5] Slope factors and unit risks are appropriate measures of carcinogenic potency when the dose-response is thought to be linear. The new proposed guidelines include extensive discussion on the use of a margin-of-exposure or RfD approach for carcinogens in which there is evidence of a nonlinear dose-response or a dose threshold for the carcinogenic response.

on any organ system following absorption and distribution of a toxicant to a site in the body distant from the toxicant's entry point. A measure of toxicologic potency for chronic (long-term) effects is the "reference dose" or "reference concentration." The reference dose (RfD) is defined as "an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without appreciable risk of deleterious effects during a lifetime" and is expressed as a mg/kg-day dose (U.S. EPA, 1997e). The reference concentration (RfC) is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily inhalation exposure of the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious noncancer effects during a lifetime. Conversion of RfCs to the more traditional RfDs is straightforward using a 20 m^3/day inhalation rate and a 70-kg body weight (U.S. EPA, 1997f). RfD values for inhalation were derived from RfCs and are used in this study. The RfD is usually based on the most sensitive known effect (i.e., the effect that occurs at the lowest dose) and can exist for both oral exposures (RfD_o) and continuous inhalation exposures (RfD_i).[6] Although some RfDs are based on actual human data, they are most often calculated from results obtained in chronic or subchronic animal studies. The basic approach for deriving an RfD involves determining a "no-observed-adverse-effect level (NOAEL)" or "lowest-observed-adverse-effect level (LOAEL)" from an appropriate toxicologic or epidemiologic study and then applying various uncertainty factors and modifying factors to arrive at the RfD. Uncertainty factors are used to derive RfDs and RfCs to account for factors that may alter toxicity. In the absence of sufficient toxicity data to assess risk, the objective is to ensure that estimates are protective of human health, including sensitive subgroups, rather than underestimating the toxicity of chemicals that may pose health risks.

Evaluating risks from chronic exposures to systemic toxicants can be performed using either an RfD or an RfC. An expression of risk called a "hazard quotient" (HQ) is the ratio of the estimated chronic dose to the RfD. Similarly, an HQ can also be calculated as the ratio of the air concentration divided by the RfC. An HQ of greater than 1 would raise a concern. Hazard quotient values below one imply that adverse effects are very unlikely to occur. The greater the extent to which exceeds one, the greater the level of concern. However, it is important to remember that the hazard quotient is not a probabilistic statement of risk (i.e., an HQ of 0.001 does not mean that there is a one-in-a-thousand chance of the effect occurring). Furthermore, it is important to remember that the level of concern does not necessarily increase linearly as the quotient approaches or exceeds unity because the RfD or RfC does not provide any information about the shape of the dose-response curve.

[6] The inhalation reference dose (RfD_i) was used in this case study for evaluating the systemic toxicity of chemicals. A reference concentration (RfC) is another way of expressing the toxicologic potency of a chemical when the exposure is via inhalation.

Collection of Toxicity Information

Sources of Toxicity Data

- Integrated Risk Information System (IRIS)
- Health Effects Summary Tables (HEAST)

To generate the screening-level risk estimates for the chemicals emitted in the Partnership area, the Committee collected toxicity information in the form of cancer slope factors for carcinogenic effects and in the form of inhalation reference doses for other chronic effects. EPA staff collected this information for the Committee and entered it into the source inventory database. EPA's Integrated Risk Information System (IRIS) was chosen as the primary source of toxicity information because of its availability and because of the level of scientific review of the assessments contained in IRIS (U.S. EPA, 1997e). It should be noted, however, that IRIS does not always reflect the most recent data and assessment on a chemical. In the absence of toxicity data for a chemical from IRIS, a secondary source for data used in the assessment was the Health Effects Assessment Summary Tables (HEAST). HEAST (U.S. EPA, 1997f) summarizes published toxicity data and provides estimates of toxicologic potency, but the data in HEAST are not subjected to the same degree of review as those in IRIS. Each source of toxicity data is described in more detail in Appendix D. It should be noted that for the risk calculations, RfDs and slope factors were used. These values were derived from the RfCs and unit risk factors contained in IRIS and HEAST. Conversion of RfCs and unit risks to the more traditional RfDs and slope factors is straightforward using a 20 m^3/day inhalation rate and a 70 kg body weight. Toxicity information for more than 115 of the 175 chemicals was available from these sources. This included 28 chemicals with cancer slope factors and 93 that had RfDs, of which 57 were based on the inhalation pathway. This meant that many, but not all, chemicals could be assessed as part of the screening process.

Calculation of the Air Concentration and Potential Dose

For the initial screen, the Air Committee used the generic Turner method, a standard EPA procedure, to estimate the annual average air concentration and potential dose rate (PDR) for each chemical in the source inventory (Turner, 1994). The generic Turner method was chosen because it is based on a well-known and widely accepted approach in the scientific arena for estimating concentrations of air pollutants emitted from near-ground point sources, and the results can be easily used in a computer spreadsheet. (A description of the generic Turner method is in the text box on the next page.) The initial screen addressed only inhalation exposures to the general population that may result from air emissions from the facilities included in the source inventory. Additional sources and pathways were not addressed in this or subsequent steps of the screening exercise. It should be recognized that persons may also be exposed to certain of the studied chemicals from other sources (e.g., household products, and other pathways such as ingestion of contaminated food, soil, or water).

Calculating Ambient Air Concentration

The following is an example of the use of the generic Turner method in the Baltimore screening analysis to calculate the ambient concentration. The TRI-reported emissions of cadmium in 1994 from SCM/Millennium Specialty Chemicals was estimated as 4 lb/yr. The ambient concentration was estimated as:

Concentration (mg/m^3) = 4 lb/yr * (1kg/2.2lb) * $(4.88*10^{-6})$ = $8.87 * 10^{-6}$ mg/m^3

Calculating Dose

A very conservative estimate of potential dose was calculated assuming a distance of 100 meters from the source, an inhalation rate of 1 m^3/hour, an exposure time of 24 hours per day, an exposure frequency of 365 days per year for a lifetime of 70 years. These assumptions generally do not represent realistic activity patterns; therefore, the potential dose rate estimated is very likely higher than ones actually expected. Additionally, the potential dose represents an estimate of the total quantity of the chemical available for absorption by the specified route, in this case inhalation. The actual absorbed dose can differ significantly from the potential dose, depending on chemical-specific pharmacokinetic and metabolic factors. Using the assumptions above, the ambient concentrations calculated by the generic Turner method were converted to the annual exposure as follows:

Annual exposure (mg/yr) = Q (kg/yr) * 0.043

The procedure for deriving the conversion factor (0.043) for annual exposure shown in the above equation is provided in Appendix E.

The Generic Turner Method

Turner's (1994) sector-averaging form of the Gaussian algorithm can be used to estimate ambient air concentrations that could result from point source emissions. With certain assumptions, a multiple-term equation describing how a chemical released to the air is dispersed and diluted downwind from its source can be simplified as a conversion factor. The assumptions used are as follows:

- A pollutant release height of 3 meters;
- A person exposed 100 meters from the source;
- Neutral atmospheric stability;
- An average wind speed of 5.5 meters per second;
- A continuous release of the chemical; and
- The wind blowing in one direction 25 percent of the time.

Using these assumptions, the ambient air concentrations in units of mg/m^3 can be estimated by multiplying the annual air release (Q) of a chemical in units of kg/yr by a conversion factor. The procedure of deriving this conversion factor ($4.88 * 10^{-6}$) is provided in Appendix E.

Concentration (mg/m^3) = Q (kg/yr) * $(4.88 * 10^{-6})$

This conversion factor ($4.88 * 10^{-6}$) can be incorporated into a computer spreadsheet program that estimates ambient concentrations for all near-ground releases of interest. The ambient air concentration can be compared to an inhalation risk-based concentration. The user also has the option of converting ambient air concentration to annual exposure. The exposure is used to calculate potential dose and ultimately risk.

A potential dose rate (PDR) for the exposed individual was estimated by dividing the annual exposure by an average body weight of 70 kg and 365 days per year as follows:

PDR (mg/kg-day) = Annual exposure (mg/yr) / (70 kg * 365 days/yr)

For the previous example, the annual exposure and PDR were estimated as:

Annual exposure (mg/yr) = 4 lb/yr * (1kg/2.2lb) * 0.043 = 0.078 mg/yr

PDR = (0.078 mg/yr) / (70 kg * 365 days/yr) = $3.1 * 10^{-6}$ mg/kg-day

Calculation of Cancer Risk Estimates and Hazard Quotients

Estimates of the cancer risks and hazard quotients were made for emission sources in the inventory. When available, cancer slope factors for inhalation exposures were used in the calculations. In the absence of cancer slope factors based on inhalation exposures, oral slope factors were used in the risk calculations. For the non-cancer assessments, RfC values were converted to RfDs based on EPA-approved procedures (U.S. EPA, 1997f). Use of an estimated dose and the associated RfD was preferred because the risk assessors needed to evaluate risks for many types of scenarios. RfCs incorporate exposure assumptions and can only be used for one exposure route. As a result, RfCs were converted to RfDs and inhalation doses were calculated for the scenario being assessed (see Region 3 RBC table in Appendix D). In turn, the same estimated doses could be used in the cancer risk calculation by combining it with the cancer slope factor. In a few instances, inhalation cancer slope factors were not available and slope factors based on the oral route were used. In those cases, another uncertainty was introduced to the assessment. It cannot be assumed that oral and inhalation exposures, even at equivalent dosage rates, will result in the same toxicologic response.

Cancer Risk Estimates

These cancer risk calculations were performed using a cancer slope factor and a dose estimated from the inhalation exposure pathway. Another way of calculating cancer risks is to use an approach that uses the unit risk factor and the air concentration. The resulting estimated risks from either approach would be the same as long as the same exposure assumptions are used (e.g., inhalation rate and body weight). Future case studies that implement this methodology will likely use the unit risk factor approach. The unit risk factor (available from IRIS) is expressed in units such as $1/(mg/m^3)$, so multiplication of the unit risk by a given air concentration (in mg/m^3) will yield a cancer risk. This equation assumes the exposure is over a lifetime (70 years). The "lifetime of exposure" includes assumptions of 20 m^3/day inhalation rate, 24 hr/day, 365 days/yr, 70 years exposure duration (equal to a lifetime), and an adult body weight of 70 kg.

An example of the risk calculations for the emissions of cadmium from the SCM facility is shown below:

Cancer risk = Cancer slope factor * Potential dose 6.3 = $(mg/kg\text{-}day)^{-1}$ * 3.1 * 10^{-6} mg/kg-day = 1.95 * 10^{-5}

Hazard quotient = Potential dose/RfD = 3.1 * 10^{-6} mg/kg-day / 5 * 10^{-4} mg/kg-day = 6.2 x 10^{-3}

Source Inventory Database

All toxicity values, exposure estimates, and risk calculations used by the Air Committee in the initial screening were incorporated into the source inventory database. An excerpt from the database for several chemicals is provided below as an illustration of the major database fields that were used in the risk calculations. The example shows how risk and hazard estimates are made for single sources of specific air pollutants using the Turner method.

Pollutant Name	Inhalation Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$	Inhalation Reference Dose (RfD) mg/kg-day	Maximum Total Air Emissions (lbs/yr)	Potential Dose (mg/kg-day) (based on Turner)	Risk (dose*SF) (based on Turner)	Hazard (dose/RfD) (based on Turner)
Acetonitrile		0.0143	4,370	3.34e-03	0.00E+000	2.33e-01
Ammonia		0.0286	290,000	2.21e-01	0.00E+000	7.74e+00
Benzene	0.029	0.00171	7,156*	5.46e-03	1.58E-004	3.19e+00
Carbon tetrachloride	0.0525	0.000571	2,820	2.15e-03	1.13E-004	3.77e+00
Ethylbenzene		0.286	1,772.8	1.35e-03	0.00E+000	4.73e-03
Hydrochloric acid		0.00571	707,808	5.40e-01	0.00E+000	9.46e+01
Toluene		0.114	262.99	2.01e-04	0.00E+000	1.76e-03

Note: This benzene example is from the Baltimore composting facility. Those releases turned out to be inaccurate, as described in the subsequent screening steps (see Table 4).

Selection of Screening Values

To set screening values, the Air Committee chose a risk level of 1 in 1,000,000 (10^{-6}) for chemicals causing cancer and a hazard quotient greater than 1 (HQ>1) for chemicals with other chronic effects. While this was a consensus decision, there was considerable discussion on the choice of screening values. Because the State of Maryland uses a 10^{-5} risk level for the permitting of facilities that have carcinogenic air emissions, Committee members were concerned that the choice of a more stringent screening value might be

Air Committee's Risk Screening Values

- 10^{-6} for Cancer Risk
- Hazard Quotient >1 for Other Chronic Effects

misinterpreted as a critique of the Maryland standards. Despite this concern, the Committee decided that the goals of the Committee justified the use of screening values that differ from the Maryland standards. The Committee decided to stay with the more stringent risk values for several reasons. The Committee designed the screening exercise to identify priority areas for voluntary pollution prevention, not to identify permit violations. The Committee recognized Maryland's concern for misinterpreting of the screening values and decided to make special efforts to clearly communicate the nonregulatory purposes of the screening exercise. The Committee also felt that the 10^{-6} screening value for cancer risk would identify those chemicals that should be considered in the siting of new facilities. Overall, the Committee chose the 10^{-6} screening value as part of its effort to design a screening exercise that would err on the side of extra protection. Using a stringent screening value would help to ensure that any chemicals that might be of concern to the community would be identified and that chemicals not identified for further review would be unlikely to present a significant risk to the community.

Comparison of Cancer Risk Estimates and Hazard Quotients to Screening Values

Cancer risks and hazard quotients were calculated for all chemicals emitted in the Partnership area using the generic Turner method. Ambient air monitoring data were also used in the initial screen to determine if air concentrations might result in risks that exceeded the screening levels. Data from the MDE air monitoring station located in Fairfield, north of the FMC facility, were available for 1992 through 1996. This is the only air monitoring station located in the Partnership neighborhoods that gathers information on air pollutants. This monitoring station takes air samples every day and data are available on the annual average, minimum, and maximum concentrations for 41 toxic chemicals. Of the 41 chemicals monitored, 4 had annual average concentrations in 1996 that resulted in risks that exceeded the Committee screening values (benzene, 1,3-butadiene, carbon tetrachloride, and methyl chloride). The Committee next sorted the cancer risk and hazard quotient columns of the database in descending order to identify the chemicals emitted from the facilities that had cancer risks greater than 10^{-6} and/or a HQ of >1. To satisfy cancer risk and hazard quotient screening criteria, a chemical had to exceed the criteria for at least one facility.

The risk screening criteria were exceeded for 25 chemicals in the inventory. These are listed below:

1. Formaldehyde	14. 1,3-Butadiene
2. *Aldrin	15. Carbon tetrachloride
3. Methyl chloride	16. *Ethylene oxide
4. Benzene	17. Dioxins & furans
5. Methylene chloride	18. Toluene
6. *Acrylamide	19. Hydrochloric acid
7. Cadmium & compounds	20. Manganese & compounds
8. *Perchloroethylene	21. Ammonia
9. *Trichloromethane	22. Hydrogen sulfide
10. *Trichloroethylene	23. *Chlorine dioxide
11. Arsenic & compounds	24. 1,2-Dichloropropane
12. Chromium & compounds	25. Mercury
13. Vinyl chloride	

* Chemicals with an "*" were not selected for the next stage of the screening process for reasons such as the chemicals were no longer emitted from the facility because of changes in the production process or the facility was no longer in operation.[7]

A formal attempt to calculate aggregate exposure from multiple sources was not made in the initial screening process. The risk screening values of 10^{-6} for cancer and HQ > 1 for other effects were used to screen only individual sources. Although the Committee did not develop a formal procedure for calculating aggregate exposures in the initial screening, it informally reviewed the risk calculations to see if combining the emissions of individual chemicals from multiple sources could potentially result in additional chemicals exceeding the screening criteria. This review was performed by sorting the database by chemical so that all the risk calculations for each chemical could be viewed at once. If a chemical had no individual facility exceedances of $> 10^{-6}$ for cancer risk or HQ >1 for other effects, but would possibly exceed those criteria when combining the emissions from multiple sources, it would have been selected for further analysis. However, this informal screening for aggregate exposures did not result in any new concerns. (See the lessons learned section for a recommendation regarding the development of a more formal method for screening for aggregate exposures in the initial screening step.)

In addition to the cancer risk and hazard quotient screening criteria, the Committee used other screening criteria to select chemicals for further review. Several chemicals were chosen for inclusion because they had very high emission quantities. These chemicals were as follows:

- Sulfur oxides (SO_x)
- Nitrogen oxides (NO_x)
- Carbon monoxide (CO)
- Carbonyl sulfide
- Xylenes

[7] A lesson learned for this stage of the screening was the need to keep detailed records of the decisions made and the reasons for the decisions. This will make it easier to present a more complete summary of the initial screening step.

Total emission rates in the Partnership area for sulfur oxides, nitrogen oxides, carbon monoxide, and carbonyl sulfide were greater than 1 million lb/yr each. Because the total emission rate for xylenes was relatively high (> 400,000 lb/yr), it was also selected.

The Committee also used professional judgment to select additional chemicals for review. This was especially important for those chemicals for which there was no toxicity information available at the time of the screening exercise.[8] Committee members used their diverse backgrounds and experience in the fields of exposure assessment, toxicology, risk assessment, and regulation of air emissions to make these judgments. The following chemicals were included using these more subjective criteria:

- Hydrogen fluoride
- Lead
- Nickel
- Stoddard solvent
- Sulfuric acid
- Molybdenum trioxide

The results of the initial screen, including the chemicals of concern and their basis for selection, are provided in Table 2. With the inventory of chemicals now reduced, the Committee proceeded to look more carefully at the remaining 29 chemicals. Details of the analysis for the 29 chemicals in the next step of the process (the secondary screen) are provided in the following chapter.

[8] Toxicity data are not available for all chemicals and for all health effects. Such data may not be available because the chemicals have not been tested and because consensus has not been reached on the toxicity value. This risk screening exercise was performed in 1997 based on available data at the time. The toxicity data contained in IRIS and HEAST are regularly updated. However, additional chemicals would not have been identified from the initial screen even if more current toxicity data were used.

Table 2. Chemicals Selected from Initial Screen

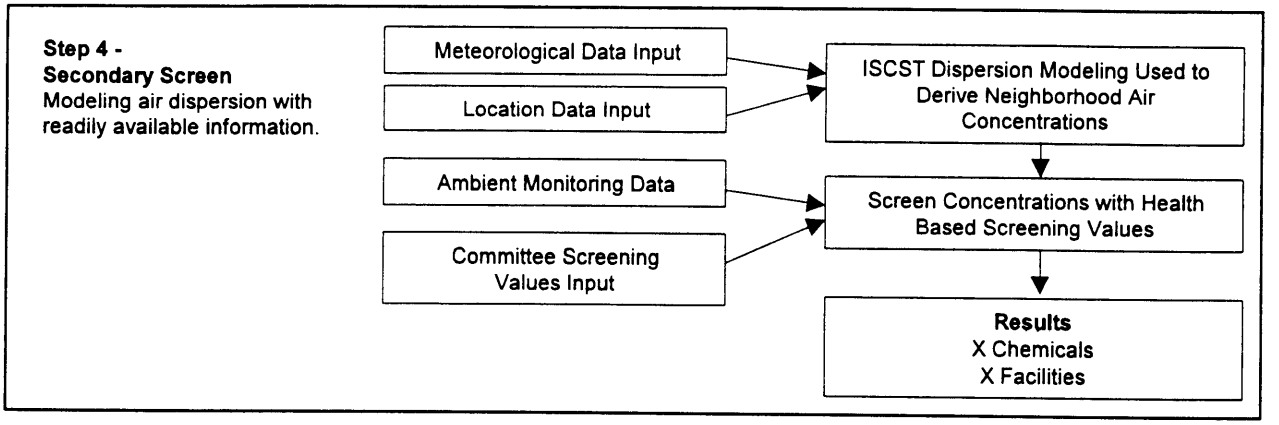
Chemical Name	CAS Number	No. of Facilities	Basis for Selection[a]
Ammonia	7664-41-7	14	HQ > 1
Arsenic	7440-38-2	5	Cancer risk estimate > 10^{-6}
Benzene	71-43-2	23	Cancer risk estimate >10^{-6}/Monitoring data
1,3-Butadiene	106-99-0	1	Cancer risk estimate > 10^{-6}/Monitoring data
Cadmium	7440-43-9	3	Cancer risk estimate > 10^{-6}
Carbon monoxide	630-08-0	51	Over 1,000,000 in total emissions
Carbon tetrachloride	56-23-5	4	Cancer risk estimate > 10^{-6} and HQ > 1 /Monitoring data
Carbonyl sulfide	463-58-1	1	Over 1,000,000 in total emissions
Chromium compounds (III, VI)	7440-47-3	10	Cancer risk estimate > 10^{-6} and HQ > 1
1,2-Dichloropropane	78-87-5	1	Cancer risk estimate > 10^{-6}
Dioxin (2,3,7,8-TCDD)	1746-01-6	3	Cancer risk estimate > 10^{-6}
Formaldehyde	50-00-0	5	Cancer risk estimate > 10^{-6}
Hydrochloric acid	7647-01-0	20	HQ > 1
Hydrogen fluoride	7664-39-3	1	General criteria: Toxicity concerns + emission sources
Hydrogen sulfide	7783-06-4	4	HQ > 1
Lead	15347-57-6	3	General criteria: Toxicity concerns + emission sources
Manganese	7439-96-5	7	HQ > 1
Mercury	7439-97-6	2	HQ > 1
Methyl chloride	74-87-3	2	Cancer risk estimate > 10^{-6}/Monitoring data
Methylene chloride	75-09-2	7	Cancer risk estimate > 10^{-6}
Molybdenum trioxide	1313-27-5	1	General criteria: Toxicity concerns + emission sources
Nickel	7440-02-0	7	General criteria: Toxicity concerns + emission sources
Nitrogen oxides	11104-93-1	79	Emissions > 1,000,000 lb/yr

Table 2. Chemicals Selected from Initial Screen (Continued)

Chemical Name	CAS Number	No. of Facilities	Basis for Selection[a]
Stoddard solvent	8052-41-3	2	General criteria: Toxicity concerns + emission sources
Sulfur oxides	SEQ:111[b]	48	Emissions > 1,000,000
Sulfuric acid	7664-93-9	13	General criteria: Toxicity concerns + emission sources
Toluene	109-88-3	40	HQ > 1
Vinyl chloride	75-01-4	2	Cancer risk estimates > 10^{-6}
Xylene	1330-20-7	49	Emissions (49 facilities with total emissions of 433,000 lb/yr)

a. All chemicals, except four, were selected on the basis of modeling air concentrations from emissions. The four chemicals selected based on ambient air monitoring data were benzene, 1,3-butadiene, carbon tetrachloride, and methyl chloride.
b. Chemical not registered by the Chemical Abstract Service. Sequence (SEQ) numbers are assigned arbitrarily.

SECONDARY SCREEN (STEP 4)



Overview

The 29 chemicals identified in the initial screen were the starting point for the secondary screen. Instead of using the Turner method to estimate concentrations, computer air dispersion modeling was used in this step to estimate aggregate concentrations from the facility sources. This air dispersion modeling provided a more realistic estimate of exposures than the very protective calculations used in the initial screen and was consistent with the kind of tiered modeling approach recommended in "A Tiered Modeling Approach for Assessing the Risks Due to Sources of Hazardous Air Pollutants" (U.S. EPA, 1992b). New information required for the secondary screening included facility location information and local meteorological data. The Air Committee also chose new screening values, described below, for this and the final step of the screening exercise. Chemicals that were identified in the initial screen based on monitored concentrations were also kept on the list of chemicals for further review in the secondary screen.

Secondary Screen

- 29 Chemicals Identified from the Initial Screen Used as the Starting Point
- Air Dispersion Model Used To Estimate Ambient Air Concentrations
- New Committee Screening Values set at 50 percent of Risk-Based Concentrations (RBCs) Developed by EPA Region 3
- Secondary Screen Identified 7 Chemicals of Concern from 23 Facilities

Modeling efforts for the 29 chemicals were performed by the EPA technical staff using the Industrial Source Complex Short-term Version 3 (ISCST3) model to estimate ambient concentrations (U.S. EPA, 1995). This model takes into account emissions from point and area sources and estimates the dispersion of chemicals in the ambient air by using local meteorology

data. The output from ISCST3 are estimates of hourly, monthly, and/or annual concentrations at receptor locations. The time required for modeling depends on the number of sources and the chemicals selected for modeling. The modeling for this project took several weeks to complete. General modeling efforts included:

- Building a modeling input file using data from the source emissions inventory database,
- Developing a grid system for the model,
- Locating facilities and neighborhoods in the modeling grid, and
- Running the model.

Appendix K provides background information on model setup, assumptions, and a chronology of modeling runs with ISCST3. Modeling scenario 1 in Appendix K is the modeling for the secondary screen. Scenario 2 represents an intermediate step that included more accurate information on emissions. Scenario 3 incorporated additional information on the type of chromium (Cr^{+3} or Cr^{+6}) emitted by facilities, and added updated data on benzene emissions. Scenario 4 was used to determine the contribution of individual facilities' benzene emissions to the total modeled benzene concentration in Wagners Point.

Once the input was completed, estimates were generated of the chemical concentrations in each neighborhood from all known releases of a chemical, along with estimates of the highest concentrations modeled anywhere within the grid system. The estimated air concentrations were compared to the screening values chosen by the Committee. Monitored concentrations were also compared to the new screening values. For the secondary screening step, the Committee decided to switch and use the Region 3 risk-based concentrations (RBCs) as the basis for its screening values. The Region 3 RBCs were calculated to correspond to a 1 in 1,000,000 (10^{-6}) cancer risk and/or an HQ of 1. The Committee decided to use 50% of the Region 3 RBCs as its screening value. These were more protective values than the ones used in the initial screen.

At this point in the process, the Committee also decided to group chemicals that have similar effects (e.g., neurological effects and respiratory tract irritants) to look at the possibility of cumulative effects that might result from exposure to combinations of different chemicals. Details of this cumulative screening are discussed below.

Results of the secondary screen showed that concentrations for 7 of the 29 chemicals were above the Committee screening values in one or more

Secondary Screen Results

- 7 Chemicals Above Committee Screening Values

- Modeled Chemicals
  - Benzene
  - Chromium
  - Hydrochloric Acid
  - Manganese

- Monitored Chemicals
  - Benzene
  - 1,3-Butadiene
  - Carbon Tetrachloride
  - Methyl Chloride

Partnership neighborhoods. Four chemicals were identified by modeling, four chemicals were identified by monitoring, and one chemical was selected by both. The Air Committee decided to carry these seven chemicals to the final screen. The Committee did not communicate the results of this step to the community at large. Although the Committee did not reach a consensus on the communication of these results to the community, the Committee held several discussions on the interpretation of the screening results. Several draft reports from this screening exercise were prepared, but they were not approved for release to the community by the Committee. Communication with the facilities that were not already members of the Partnership, but were releasing chemicals with estimated concentrations at or above the screening values, was initiated to encourage participation.

In addition to air modeling, the Air Committee focused on providing Committee members with background information to ensure that each member understood the steps in the process and could fully participate in the discussions and decisions. Therefore, the Committee organized a special meeting devoted to explaining and discussing the basic science of the screening exercise, as well as toxicology, exposure, risk, and modeling. Residents communicated their concerns about facility emissions and explored whether air dispersion modeling could provide answers to their questions. The Air Committee attempted to answer all the questions from the members (and the Committee) to ensure confidence in the overall screening process.

Completing the Secondary Screen

The 29 chemicals selected from the initial screen were carried through the secondary screen to determine if they were chemicals of concern.

Air Dispersion Modeling

Air dispersion modeling was conducted using Version 3 (ISCST3) model. ISCST3 has been tested, validated, and widely used by EPA and State government organizations for risk assessment, regulatory, and permitting purposes. This model was selected for a variety of reasons, including its ability to be tailored for local conditions and to model chemical emissions from multiple sources (U.S. EPA, 1987). ISCST3 was used to estimate the ambient concentrations of chemicals emitted from the wide variety of air pollution sources associated with industrial activities in and around the Partnership area. The results of the modeling were used to determine which air pollution stationary sources needed further characterization and which could be screened out as not likely to

Air Dispersion Modeling for Step 4

- ISCST3 Model Used
- Emissions from Point and Area Sources Considered
- Model Estimated Annual Average Concentrations at Receptor Locations
- Receptor Sites Included:
  - Brooklyn/Brooklyn Park
  - Cherry Hill
  - Wagners Point
  - Curtis Bay

have a significant impact on human health. For chemicals that were emitted by too many facilities to feasibly model, enough facilities were chosen so that at least 95 percent of the total mass emitted was captured. Professional judgment was used to verify that omitted facilities would not affect the analysis (e.g., low quantities were emitted or facilities were not located near populated areas).

Model Description

ISCST3 was designed to calculate ground-level average concentrations and/or total deposition values emitted from single or multiple stationary sources (U.S. EPA, 1995). ISCST3 uses meteorological data and site-specific parameters (e.g., stack parameters and pollutant emission rates) to calculate hourly, monthly, and/or annual average concentrations, as well as deposition values. The calculations can be performed at each receptor (neighborhood) on a coordinate grid for each source or for combined emissions from select groups or all sources.

For the purpose of ISCST3 modeling, stationary sources in the Partnership area were divided into point and area sources,[9] based on the characteristics of their emissions. Point sources are generally associated with a specific point defined by the location on the emissions/receptor coordinate grid. In the modeling exercise, point sources are generally exhaust stacks with a defined height, diameter, and other associated variables. The emission rates entered into the model for these types of sources were in units of mass per unit time (e.g., lb/hr). Area sources in the context of ISCST3 modeling are emissions that do not originate from a specific point, such as a stack, but are emitted from an area of known width and length (e.g., evaporation from a wastewater treatment plant or leaks from a fuel terminal). The emissions rates entered into the model for these types of sources were in units of mass per area per unit time (e.g., pounds per square foot per hour [$lb/ft^2/hr$]). The use of the term "area source" in this context should not be confused with that of "area source" under the Clean Air Act (i.e., a stationary source of hazardous air pollutants that is not a "major" source).

Model Setup and Assumptions Used

ISCST3 requires emissions data, meteorological data, and facility information as modeling input. The emissions of each chemical and stack parameters for each facility studied were identified from information provided by MDE. (Example shown in Appendix F.) In most cases, maximum permitted emissions of each chemical for each facility were used as the emissions input for the secondary screen. The characterization of each emission as stack or fugitive was made based on professional judgment by an engineer familiar with most of the facilities. Both toxic and criteria air pollutants were modeled using local meteorological data from the most current years

[9] The terms point sources and area sources, when used in the context of dispersion modeling, are different than when used for defining types of sources based on the Clean Air Act (point, area, mobile sources). See footnote number 2 for further discussion.

available (1987-1988, 1990-1992). Generally, meteorological data over a 5-year span are used in air dispersion modeling to account for temporal variations.

Data to characterize area sources were not available as part of the secondary screen. Default assumptions based on the best engineering judgment were used as follows: small area sources (such as gas stations) were assumed to be 50 x 50 meters and 3 meters emissions height. Large area sources (such as large industrial facilities) were assumed to be 500 x 500 meters and 30 meters emissions height.

Receptor Grid and Model Outputs

ISCST3 was run using a Cartesian coordinate source and two receptor grids. The coarse grid with 2,000 m spacing was 18,000 16,000 m, or about 110 square miles (Figure 3). This coarse grid allowed for prediction of air concentrations for 72 receptor locations in a 110-square-mile area around the Partnership neighborhoods. The coarse grid was used in order to reduce the number of computations when including facilities up to 5 miles away from the Partnership area. Since no calculations outside of the Partnership neighborhoods were needed for the distant emissions sources, but the coarse grid could still provide estimates within the Partnership neighborhoods for these pollutants, use of the coarse grid was preferred over the much more computationally demanding fine grid covering the same area. The fine grid, with 250 m grid spacing, was 5,000 meters on a side, or about 10 square miles. This fine grid provided better resolution of the air concentrations (at 700 receptor locations) in the Partnership neighborhoods (Figure 4).

Selection of Facilities Modeled

For the priority chemicals with multiple emission sources, a subset of 36 sources was selected to reduce the number of facilities for air modeling. The focus was placed on those facilities whose emissions accounted for at least 95 percent of the mass of total emissions. For example, manganese was emitted by seven facilities, but only two facilities were modeled (Chemetals and Bethlehem Steel) because they accounted for more than 95 percent of the total mass of manganese emitted in the Partnership area. An additional selection criterion was used in the case of benzene to cover the range of sources so that some small sources such as gas stations were included along with the larger sources of emissions. The facilities selected for air modeling for this stage of the analysis are listed in Appendix H.

Selection of Receptor Sites

ISCST3 was used to estimate ambient air pollutant concentrations for the 4 Partnership neighborhoods, Cherry Hill, Brooklyn/Brooklyn Park, Curtis Bay, and Wagners Point. The coordinates used for modeling corresponded with the approximate geographic centers of these four communities. Recognizing that air pollutants may be transported from outside the Partnership area, facilities within 5 miles of the Partnership area were included in the emissions

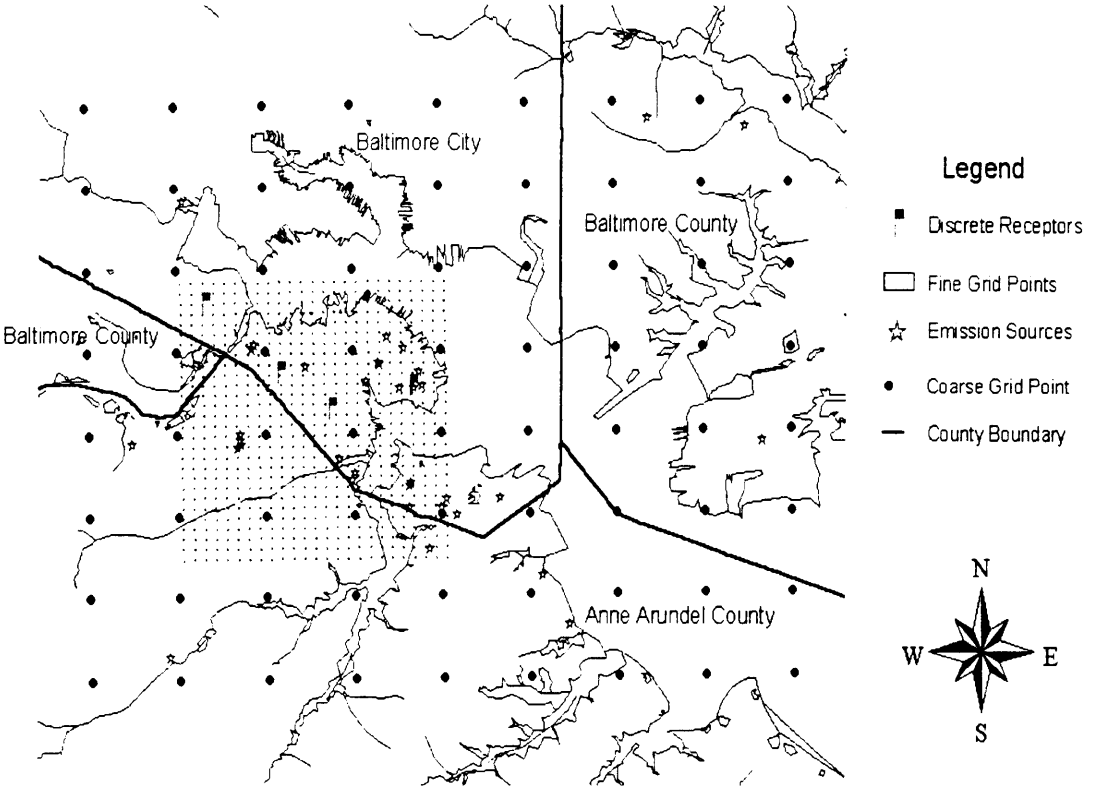


Figure 3. Coarse Receptor Grid in Baltimore

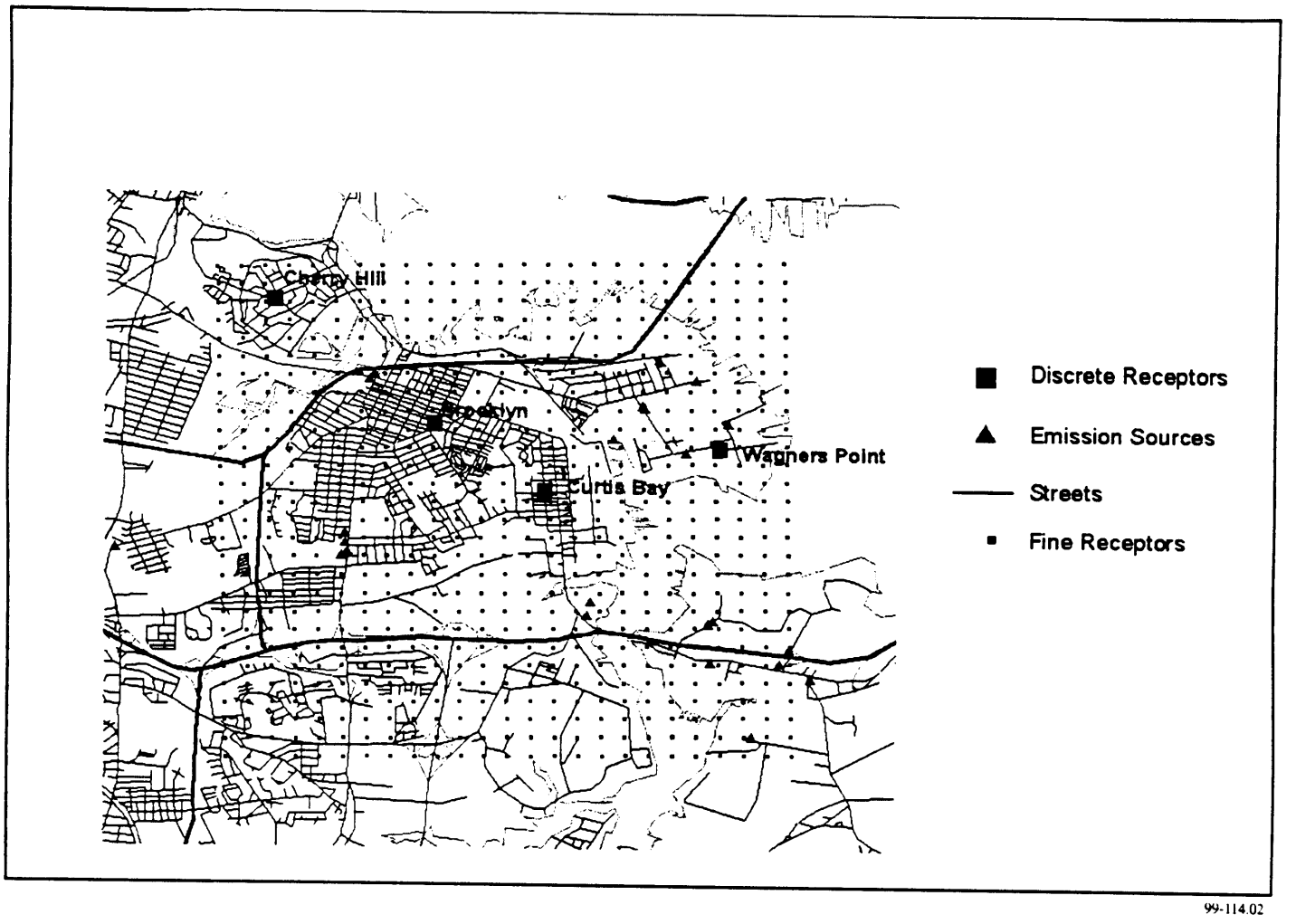


Figure 4. Fine Receptor Grid in Baltimore

inventory. While this approach did not capture pollution transported from other regions of the United States, it represents an exhaustive attempt to consider local commercial and industrial stationary sources (Figure 4).

Selection of Health-Based Screening Levels and Endpoints

For this stage of the screening process, the Committee used 50 percent of the RBCs calculated by Region 3 as the screening values. The RBCs provided a concentration benchmark to compare directly to the concentrations estimated by the modeling or measured at the monitoring stations. The RBCs (U.S. EPA, 1997d) are the concentrations at which either the cancer risk to an exposed population is 1 in 1,000,000 or the HQ is 1. If the monitored or modeled concentrations exceeded 50 percent of the RBCs, then the chemical was identified as a candidate for further analysis. The assumptions built into the RBCs are provided in Appendix D. A review and potential adjustment of these assumptions was identified for future improvement of the screening methodology to ensure the protection of sensitive populations.

Grouping of Chemicals with Similar Target Organs or Physiological Systems

The Air Committee reviewed the toxicology information for the 29 chemicals to screen for possible cumulative effects from exposure to multiple chemicals and to identify chemicals with similar target organs or physiological systems. On the basis of this review, chemicals with known neurological effects and chemicals that act as respiratory tract irritants were grouped together. Cumulative exposures resulting from the chemical groupings did not result in any new concerns. The chemicals reviewed and results of the cumulative assessment can be seen in Table I-2 in Appendix I.

Chemicals with Monitoring Data

Data from a monitoring station located within the Partnership area were available for 4 of the 29 chemicals: benzene, 1,3-butadiene, carbon tetrachloride, and methyl chloride. (See Appendix F for an example of air toxics monitoring data.) These data were compared with the screening concentrations to determine if the monitored levels were greater than the modeled levels and/or the screening levels. All four chemicals were found at levels above the RBCs, so additional study of on these chemicals was warranted as part of the final screen. For 1,3-butadiene, evaluation was based only on monitoring data because there were no significant stationary emission sources in the Partnership area to model.

Results of Secondary Screening

The 29 chemicals selected in the initial screening step, including 18 by risk screening, 5 by emission quantity, and 6 by professional judgment, were carried through the secondary screen for further analysis. Monitoring data for any of these chemicals, if available, were examined to determine whether monitored data or modeled data had higher concentrations. The data with higher concentrations were compared against the risk screening values before performing the next step. The estimated concentrations and monitored concentrations, as well as the corresponding percentage of the screening value for each concentration, were presented in table format for Committee review. This table is presented in Appendix I. A second table, indicating only whether or not more information was needed, was also developed for Committee review. (See Table 3.) Those chemicals having concentrations above the committee screening level were identified as needing further analysis in the final screen step.

Chemicals Not Requiring Further Evaluation

For 22 of the 29 pollutants, estimated concentrations from modeling or measured concentrations from monitoring were well below the Air Committee's screening criteria in all the neighborhoods. Because of the low concentrations, the Air Committee concluded that no further evaluation was needed for the 22 chemicals.

Secondary Screening Chemicals

Seven of 29 Pollutants Exceeded 50 Percent of Screening Value in One or More Neighborhoods.

• Benzene	from *monitored* and *modeled* concentrations
• 1,3-Butadiene	from *monitored* concentrations
• Carbon Tetrachloride	from *monitored* concentrations
• Chromium	from *modeled* concentrations
• Hydrochloric Acid	from *modeled* concentrations
• Manganese	from *modeled* concentrations
• Methyl Chloride	from *monitored* concentrations

Chemicals Recommended for Further Evaluation

Concentrations for 7 of the 29 pollutants exceeded 50 percent of their respective screening values in one or more of the neighborhoods. Benzene, 1,3-butadiene, carbon tetrachloride, and methyl chloride were identified based on the monitored concentrations. Benzene, chromium, hydrochloric acid, and manganese were identified by the modeled concentrations. (Benzene had both monitored and modeled concentrations greater than 50 percent of its RBC.) The Air Committee recommended further evaluation for each of these seven chemicals as part of the final screening step.

Interpretation and Communication of Results

The results of the screening exercise were presented to the Committee in different table formats, and the advantages of each format were discussed. Draft reports interpreting these results were also discussed in the Committee. At this point, the Committee did not reach a consensus on a format for the presentation of the information to the community.

Table 3. Results of Secondary Screening for Target Toxics in Partnership Neighborhoods

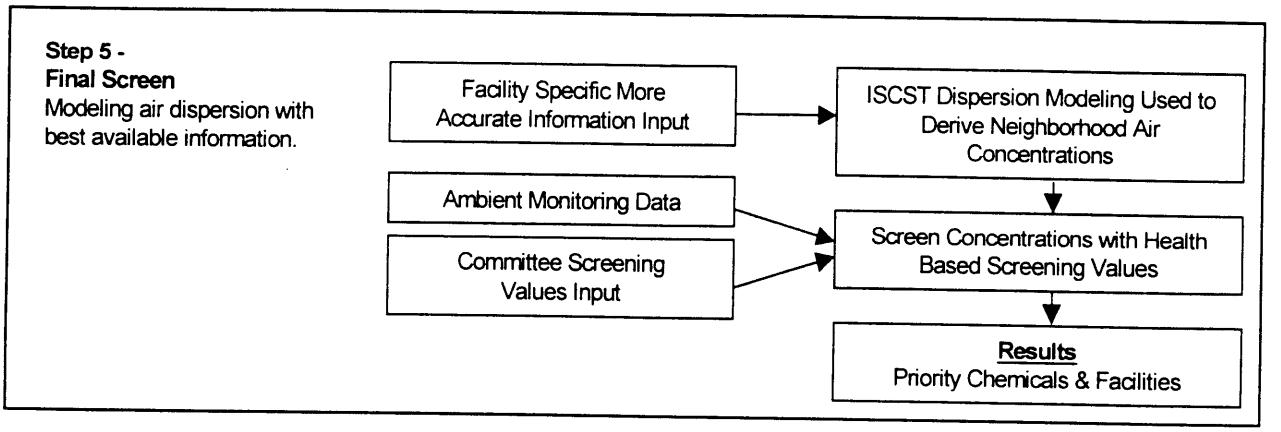
Chemical	Neighborhood Concentrations (from modeling)				State-Operated Monitoring Station Results
	Cherry Hill	Brooklyn/ Brooklyn Park	Curtis Bay	Wagners Point	
Ammonia	Low[a]	Low	Low	Low	
Arsenic*	Low	Low	Low	Low	
Benzene*[b]	Low	Low	Low	**Needs more information[c]**	**Needs more information**
1,3-Butadiene*[d]	--	--	--	--	**Needs more information**
Cadmium*	Low	Low	Low	Low	
Carbon monoxide	Low	Low	Low	Low	
Carbon tetrachloride*	Low	Low	Low	Low	**Needs more information**
Carbonyl sulfide	Low	Low	Low	Low	
Chromium (Hexavalent)*	**Needs more information**	**Needs more information**	**Needs more information**	**Needs more information**	
Chromium (Trivalent)	Low	Low	Low	**Needs more information**	
1,2-Dichloropropane*[e]	Low	Low	Low	Low	
Dioxin* (2,3,7,8 TCDD)	Low	Low	Low	Low	
Formaldehyde*	Low	Low	Low	Low	
Hydrochloric acid	Low	Low	**Needs more information**	**Needs more information**	

Table 3. Results of Secondary Screening for Target Toxics in Partnership Neighborhoods (continued)

Chemical	Neighborhood Concentrations (from modeling)				State-Operated Monitoring Station Results
	Cherry Hill	Brooklyn/ Brooklyn Park	Curtis Bay	Wagners Point	
Hydrogen fluoride	Low	Low	Low	Low	
Hydrogen sulfide	Low	Low	Low	Low	
Lead	Low	Low	Low	Low	
Manganese	Low	Low	**Needs more information**	**Needs more information**	
Mercury	Low	Low	Low	Low	
Methyl chloride*	Low	Low	Low	Low	**Needs more information**
Methylene chloride*	Low	Low	Low	Low	
Molybdenum trioxide	Low	Low	Low	Low	
Nickel	Low	Low	Low	Low	
Nitrogen oxides	Low	Low	Low	Low	
Stoddard Solvent	Low	Low	Low	Low	
Sulfur oxides	Low	Low	Low	Low	
Sulfuric acid	Low	Low	Low	Low	
Toluene	Low	Low	Low	Low	
Vinyl chloride*	Low	Low	Low	Low	
Xylene	Low	Low	Low	Low	

a. Low concentrations from modeling; no further work was needed.
b. (*) refers to carcinogens.
c. Areas marked as "Needs more information" had modeled concentrations above 50 percent of the risk-based concentration (RBC) chosen by the Partnership Air Committee. These chemicals were candidates for further screening.
d. Modeling was not conducted because facility emissions were not available.
e. 1,2-Dichloropropane is a carcinogen via the oral route.

FINAL SCREEN (STEP 5)



Overview

The final screening step used the most accurate information available to better characterize annual emissions. This refined information was used to identify the chemicals and facilities of most concern to the Partnership neighborhoods. The final screen began with the seven chemicals identified in the previous step. The seven chemicals were emitted from 23 facilities and/or measured at the local monitoring station. The final screen identified four of the seven chemicals as community priorities.

Final Screen

- Started with 7 Chemicals from 23 Facilities
- Used Refined Source Emission Data for More Accurate Modeling
- Used Ambient Air Monitoring Data for Certain Chemicals
- Result of Final Screen: 4 Chemicals (Benzene, 1,3-Butadiene, Carbon Tetrachloride, and Methyl Chloride)

To collect the most accurate information, members of the Partnership Air Committee contacted representatives of the 23 facilities or consulted MDE files to obtain annual emissions measurements or estimates from the emissions compliance statements submitted to the State each year by permitted facilities. When this information was not available, TRI emissions to air for the most recent year (1996) were used. In addition, improved data were solicited on stack heights, facility location, dimensions, and so forth, which resulted in a more accurate estimate of neighborhood concentrations by the ISCST3 modeling. Additional information on the type of chromium emitted to the air was also collected. Based on the new information, neighborhood concentrations were re-estimated and compared to the Air Committee screening values. Any chemicals with monitored or modeled concentrations above the screening values were identified as priority chemicals for the community. Step 6, which follows, describes how the Committee

developed recommendations for addressing the priority chemicals and began work to communicate the recommendations and results of the screening to the community.

Completing the Final Screen

Collection of Toxicity Information

Information on the toxicity of the remaining chemicals was found in the EPA Region 3 RBC table (U.S. EPA, 1997d). The risk screening was conducted as in the secondary screen. The only new information needed at this step was toxicity information on the type of chromium (trivalent or hexavalent) emitted from facilities in the Partnership area. Earlier screening steps used a conservative assumption that all chromium emitted from the facilities to air was the more toxic hexavalent chromium. The final screening was based on a more accurate estimate of the form of chromium in the emissions.

Air Modeling

Four of the seven chemicals selected for the final screen (benzene, chromium, hydrochloric acid, and manganese) had local facility sources. Air dispersion modeling was conducted for these chemicals using the ISCST3 model, as in the previous step. Modeling results were used to determine which facility sources should be candidates for voluntary pollution prevention and emissions reductions.

Modeling Inputs and Assumptions

For the final screen modeling, emission rates, selection of facilities, and stack parameters were refined with more accurate data. All other modeling inputs and assumptions remained the same as in Step 4. Instead of using maximum state-permitted emissions, yearly air emissions were obtained from the annual emissions compliance statements filed with MDE. This emission information was derived from stack monitoring or engineering estimates and is based on the expected performance of the facility. A comparison of the emission rates for the secondary and final screens for the four modeled chemicals can be found in Table 4.

Selection of Facilities Modeled

Twenty-three facilities with emissions of the four targeted chemicals were selected for air dispersion modeling in the final screen. The facilities, chemicals emitted, and emissions amounts are listed in Table 4.

Table 4. Emission Rates from Facilities Used in Secondary and Final Screens [a]

Facility Name	Pollutant Name	Secondary Screen Emission Rate (lb/yr)	Final Screen Emission Rate (lb/yr)
Amerada Hess	Benzene	NA	652
Amoco Oil Co.	Benzene	4,000	80
Amoco Station	Benzene	NA	66
Amoco Station	Benzene	NA	67
Baltimore Composting	Benzene	7,156	7,156[b]
Baltimore Resco	Chromium	3,333	67 (+3); 3 (+6)
	Hydrochloric acid	6,126,000	6,126,000
Bethlehem Steel	Chromium	848	848 (+3)
	Manganese	20,124	20,124
BGE Brandon Shores[c]	Chromium	909	633 (+3); 276 (+6)
	Hydrochloric acid	4,200,000	4,200,000
BGE Wagner Station[c]	Chromium	294	204 (+3); 90 (+6)
	Hydrochloric Acid	1,300,000	1,300,000
Bayway Terminal	Benzene	1,120	220
Chemetals Corp.	Hydrochloric acid	23,172	8,758
	Manganese	61,661	16,300
Citgo Station	Benzene	122	61
CONDEA-Vista Chem.	Benzene	3,000	2,200
	Hydrochloric acid	21,000	12,000
Crown Station	Benzene	NA	62
Crown Station	Benzene	NA	44
Grace Davison	Chromium	122	122 (+3)
Med Net/MedX Inc.	Hydrochloric acid	42,300	6,520
MOTIVA (Mobil Oil-Maritank)	Benzene	882	1,440
Norris Farm Landfill	Benzene	1,051	16
Phoenix Services	Hydrochloric acid	91,016	6,952
MOTIVA (Shell Oil Terminal)	Benzene	1,400	480
Shell Station	Benzene	130	65
CITCO (Star Enterprises)	Benzene	NA	348
Stratus Petroleum	Benzene	NA	880
U.S. Gypsum	Chromium	26	26 (+3)

NA Not available (several benzene sources were discussed as part of the final screen; no data were included in the secondary screen).

a. Emissions data for 1,3-butadiene, carbon tetrachloride, and methyl chloride were not included in this table, since assessment of risk was based on monitoring data and not emissions from stationary source.

b. This number was determined to be erroneous; however, the emissions did not affect the Partnership neighborhoods.

c. Estimates were based on design and operating parameters.

Results of the Final Screen

Of the four chemicals modeled in the final screen, only benzene emissions were estimated to result in airborne concentrations in a Partnership neighborhood at levels above the Committee screening level. Table 5 displays estimated air concentrations of chemicals from the secondary and final screens.

To help identify the contribution of each of the facility sources of benzene to the modeled concentrations in the Wagners Point neighborhood, model runs were conducted in a manner such that each benzene source was considered individually. The ISCST3 model was run repeatedly with only one benzene source "turned on" at a time. This yielded an estimated maximum airborne concentration due to the single emissions source under consideration. That value was compared to the estimated concentration due to all sources to determine the contribution of that source (percentage of the total). Petrochemical storage facilities in the Wagners Point area were identified as the primary source of the modeled benzene concentrations.

In addition to determining the contribution of each source to the modeled concentration, the Air Committee examined monitoring data for benzene in the Partnership area and a comparison of the two values was performed to determine how closely the modeled concentration matched the monitored concentration. The monitoring station in Fairfield is about ½ mile from the location of the highest predicted concentration of benzene in Wagners Point. At this distance the two locations could be unequally subject to influences, such as nearby benzene sources or differences in wind direction and frequency, that could confound the comparison of benzene concentrations. Nonetheless, if it is assumed that the modeling is accurate, then significant differences between measured benzene concentrations and modeled benzene concentrations could be due to sources of benzene not captured in the emissions inventory.

The results of this effort were used to develop the pie chart in Figure 5. The pie chart shows the estimated individual contribution of each facility to the ambient benzene concentrations measured at the monitoring station located approximately ½ mile from the Wagners Point neighborhood (Fairfield). This pie chart allows for a comparison of the modeled facility contributions (12 percent) to other nonmodeled sources (88 percent). It is well known that mobile sources make a significant contribution of benzene to urban air (U.S. EPA, 1999e). (Mobile sources were not modeled by the Air Committee, but their inclusion in future efforts is highly recommended.) On the basis of this information, the Air Committee concluded that a significant portion of the unaccounted for benzene concentration monitored at the Fairfield station could be attributed to mobile sources, likely benzene emitted from mobile sources (cars and trucks) passing through the area on high-volume routes such as I- 695 and Patapsco Ave and at the I-895 toll plaza. A more precise determination of the sources of the measured benzene could not be made because the Committee was unable to completely determine if all nonmobile sources had been accounted for. There may be additional unregistered local sources or other local sources not included in the modeling. There may also be some transport of benzene into the Partnership area from beyond the

Table 5. Estimated Air Concentrations of Chemicals from Secondary and Final Screens

	Concentration Averaging Time	Benzene ($\mu g/m^3$)		Chromium & Compounds Total ($\mu g/m^3$)		Chromium (+3) ($\mu g/m^3$)		Chromium (+6) ($\mu g/m^3$)		Hydrochloric Acid ($\mu g/m^3$)		Manganese ($\mu g/m^3$)	
Receptor		**Secondary**	**Final**	**Secondary**	**Final**	**Secondary**	**Final**	**Secondary**	**Final**	**Secondary**	**Final**	**Secondary**	**Final**
Cherry Hill	Annual	0.003	0.0028	0.0001	NA	NA	0.00008	NA	0.00001	1.5	1.4	0.014	0.0044
Wagners Point	Annual	0.19	0.41	0.0006	NA	NA	0.00026	NA	0.00001	8.4	0.89	0.054	0.016
Brooklyn	Annual	0.008	0.0078	0.0004	NA	NA	0.00011	NA	0.00001	1.5	0.74	0.024	0.0072
Curtis Bay	Annual	0.019	0.014	0.0004	NA	NA	0.00017	NA	0.00001	3.7	0.66	0.039	0.011

$\mu g/m^3$ = micrograms per cubic meter
NA = Not Applicable.

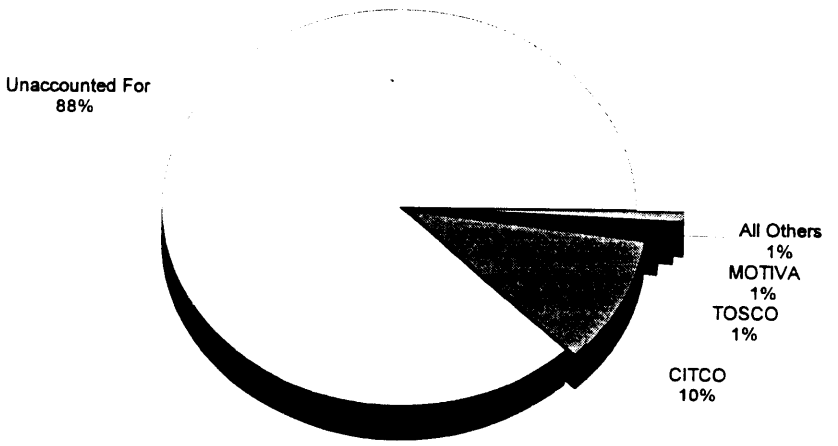


Figure 5. Comparison of Unknown to Stationary Sources of Benzene Between the FMC Monitoring Station and Modeled Concentrations

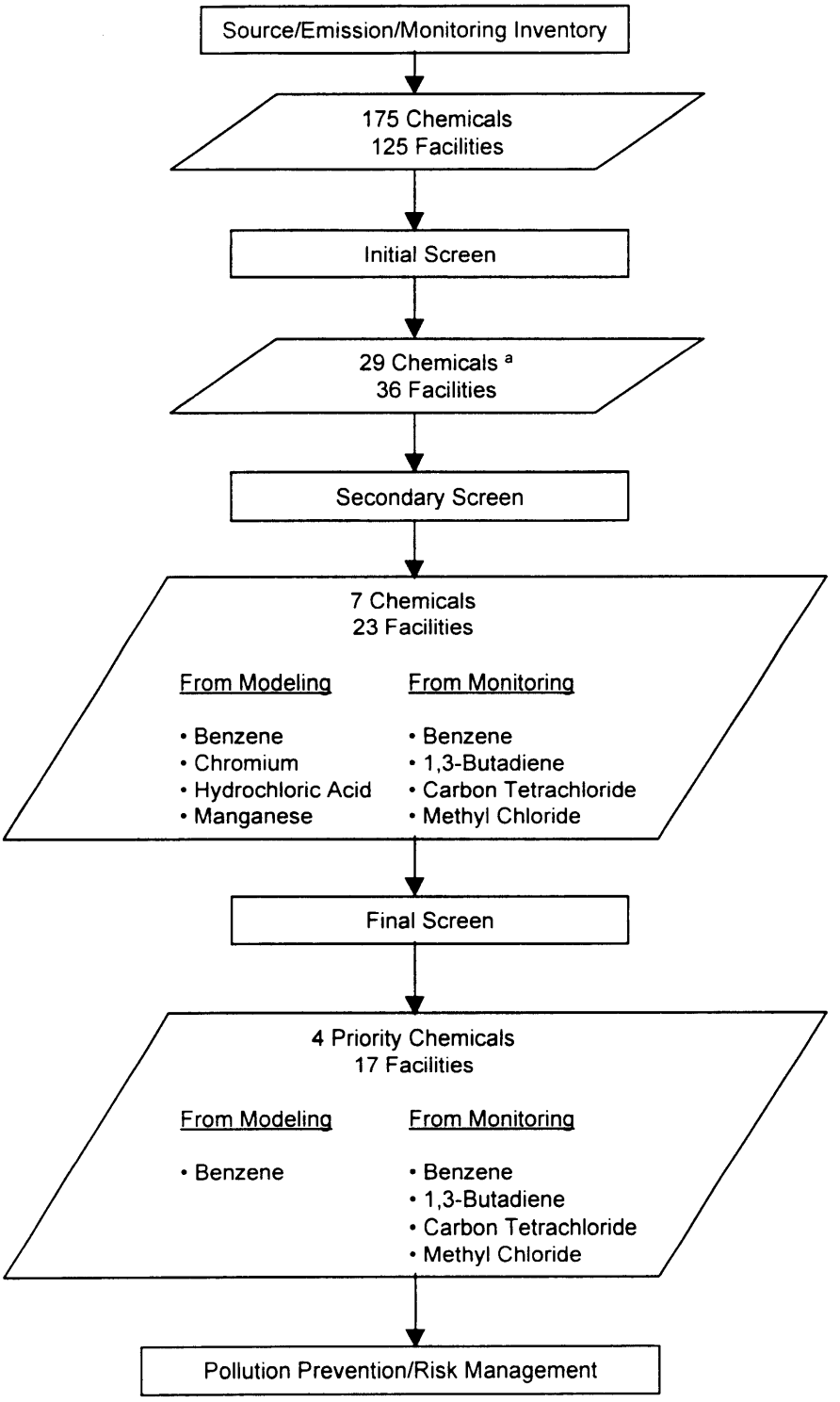
15-square-mile area considered in the study. It is also possible that the model may have underestimated the contribution of the modeled facility sources.

Ambient air monitoring data from the monitoring station in Fairfield indicated the presence of four chemicals (i.e., benzene, 1,3-butadiene, carbon tetrachloride, and methyl chloride) with annual average concentrations greater than the Committee screening levels. With the exception of benzene, no significant sources of these chemicals were listed in the emissions inventory. Benzene is emitted from both stationary and mobile sources; 1,3-butadiene most likely originates from mobile sources; carbon tetrachloride and methyl chloride are typically present in urban air at levels monitored in the Partnership area. (See description in the Air Committee Report in Appendix J.)

The results from each screening step are shown in Figure 6. Initially, the inventory consisted of 175 chemicals. As a result of the screening process, four chemicals of concern were identified, three from monitoring data alone and one (benzene) from both modeling and monitoring data.

Chemicals Identified in Final Screen

Monitoring	**Modeling**
• Benzene	• Benzene
• Methyl Chloride	
• 1,3-Butadiene	
• Carbon Tetrachloride	



[a] 18 chemicals were selected by risk screening;
5 chemicals were selected by emission quantity; and
6 based on professional judgement.

Figure 6. Baltimore Air Screening Results

DEVELOPED RECOMMENDATIONS AND COMMUNICATED RESULTS TO THE BROADER COMMUNITY (STEP 6)

Step 6 - Recommendations and Communication	Develop Pollution Prevention and Risk Management Recommendations and Communicate Results

Overview

Recommendations and Communication

- Recommendations for Reductions in Chemical Emissions and Levels
- Consideration of Types of Chemicals and Sources
- Communication of Results and Recommendations to Community

The final step of the Air Committee's work focused on the development of recommendations to improve air quality and the communication of the results of the Committee's work to the broader community. As discussed in the Introduction, work on these aspects of the screening exercise was significantly delayed when in the summer of 1998, following the completion of the final screening step, a key group of members left the Committee. Following this development, the Committee continued its work with input and direction from the Partnership's Executive Committee. At this point, the recruitment of new members became an additional goal for the Air Committee.

Recommendations for Acting on Results

Recommendations were developed to address the ambient air levels for the chemicals identified in the final screen.

Benzene in Wagners Point Resulting from Stationary and Area Source Emissions

The Committee recommended work to identify pollution prevention and risk management efforts to reduce emissions from the contributing facilities. Representatives of the bulk petroleum facilities were contacted and invited to participate in the work of the Air Committee. Company representatives and staff from the trade associations representing the companies agreed to participate and work to identify and implement opportunities to reduce emissions of benzene. In the spring of 1999, the residents of Wagners Point accepted a buyout offer unrelated to the work of the Air Committee and relocation of the community began. As a result, Committee work on the reduction of these benzene emissions was postponed.

Benzene and 1,3-Butadiene Levels Attributed to Mobile Sources

Based on its analysis, the Air Committee concluded that mobile sources contributed a significant portion of the levels of benzene and 1,3-butadiene in the Partnership neighborhoods. Toxics from mobile sources are both regional and national air problems and cannot be addressed solely in Partnership neighborhoods. As a result, the Air Committee recommended that the Partnership consider participating in air quality improvement efforts at the regional level. Both the MDE and EPA are considering new initiatives to control toxics from mobile sources and community input will be crucial to those efforts. The Air Committee made plans to invite representatives from MDE and EPA to speak to the Committee. The Committee will then develop a plan to make the community's voice heard on these issues.

Carbon Tetrachloride and Methyl Chloride

Recommendations were not developed for these chemicals based on the Committee's conclusion that their ambient levels were due to natural sources or past uses and not to any current use or emissions.

Given the limits of the study conducted by the Air Committee, which focused on emissions from industrial, commercial, and waste treatment and disposal facilities, the Committee also developed the following recommendations for additional work to address community concerns:

- Encourage appropriate actions to reduce odors;
- Encourage appropriate action to reduce diesel truck exhaust through means such as enforcement of current truck traffic restrictions, better diesel motor maintenance for vehicles regularly using local roads, and rerouting of truck traffic; and
- Develop ways to educate the community about the impacts of indoor air pollution.

Communication of the Results

The Air Committee made a major effort to find an effective way to communicate the results of its work to the broader community. Preparing a report to the community may have taken as much Committee work and time as conducting the technical screening exercise itself. The effort to effectively communicate the work of the Committee to the community began at the secondary screening step of the project. At that stage, several draft reports to explain the results of the secondary screen were prepared and discussed at length in the Committee. However, a consensus on the interpretation of the results did not develop, and the effort was halted as the results of the final screen became available.

With the results of the final screen and the recommendations in hand, the Committee began a new effort to develop a report for the public. At least 10 drafts were prepared. As a part of this process, the Committee brought together a group of residents not involved in the work to solicit their input on how to communicate the results of the screening exercise. Questions developed from this meeting were used to organize the report. The final Air Committee Report, approved in October 1999, can be seen in Appendix J.

Several factors contributed to the difficulties encountered in the effort to develop the public report. The work of the screening exercise was a new experience for all of the participants, including the technical staff working on the Committee. As a result, a considerable amount of time was spent learning about the process and its consequences. The task of summarizing the work in a public report brought all issues and questions to the surface, and building a consensus in the Committee on these issues required time and effort that could not be avoided. It was especially difficult to develop the understanding and explanation for exactly what the screening exercise could and could not accomplish. Understanding and explaining this required a review of all the data and methods used by the Committee. The Committee used an extensive peer review process to help it understand and clarify the issues raised in the report and to increase its confidence in the results. This process itself required time and effort. Explaining the relationship of the information provided in the exercise to the important questions of community health was especially difficult. In addition, some Committee members did not expect the results found in the screening exercise. The important discussion of the issues surrounding these expectations also added to the time required to summarize the work. The Committee also learned that it was not enough to summarize the results of its work, it also had to understand the community's views on the issues related to air quality and health. Learning this also took time. In all, the difficulty in drafting and finalizing the report was a reflection of the amount of educational work that was required to begin building a consensus on air quality issues in the community.

Despite all the work put into the public report found in Appendix J, the Committee recognized that it was still not adequate for broad dissemination in the community. While the Committee was convinced that it was an accurate description of its work and that the results were important information for the community, they recognized that it was still too long and technical for wide distribution. As a result, the Committee adopted a plan to present the information in the report to small groups in the community to get feedback on how to explain the screening exercise and its results. Plans were made to present the results to the local Ministerial Alliance, groups of local teachers, the chemical industry's Community Advisory Panel, Parent Teacher Association groups, a local tenants' association, and other small community groups. The Committee planned to prepare presentation, summary, and handout materials for these meetings based on the draft report. Committee presentations to small community groups are now starting. Using feedback from these meetings and its practice in preparing additional materials to explain the screening exercise and its results, the Committee plans to hold larger public meetings to disseminate the information throughout the community, as well as to recruit new members to address the issues recommended for additional work.

GENERAL OBSERVATIONS ON THE SCREENING METHODOLOGY DEVELOPED IN BALTIMORE

As explained in the introduction to this report, the screening method developed in the Partnership will undergo further development and trial. Plans are currently under way for two additional communities to use and improve this methodology. A peer review process for the methodology will also be undertaken both inside and outside the Agency. Using the experiences of the additional trials and the peer review, the screening methodology presented in this case study will be revised. The revised methodology will then be disseminated widely as a tool for community use.

Summary and Lessons Learned

- Methodology Was an Effective Screening Tool for Southern Baltimore
- Partnership Benefitted from Air Screening Exercise
- Technical Aspects of Screening Methodology Need Further Refinement

Preliminary conclusions based on the Baltimore experience indicate that the screening methodology developed in the case study and described in this report may have widespread application in communities concerned about air quality. This methodology could provide communities with an effective screening tool and with a process for building a community consensus on actions to improve air quality. Experiences in Baltimore also point out several key areas where this process can be improved. The observations and lessons learned, discussed below, will form the starting point for the further testing of the methodology.

The Methodology Provides an Effective Screening Tool for Communities

Local communities often have difficulty understanding environmental data and reaching consensus when setting priorities for effective community action. Communities are especially concerned about aggregate and cumulative exposures from the multiple sources in and around their communities. The screening methodology developed in Baltimore provides a technical tool to help communities begin to evaluate the potential impacts of sources of air pollutants in their neighborhoods and to quickly and effectively identify which chemicals might present higher than acceptable risk. The screening tool enables a community to go beyond the commonly available level of knowledge (of amounts and types of emissions) and to use information about the level of risk those chemicals might present. The methodology helps a community to combine emissions data, hazard information, exposure modeling, and risk screening in a priority-setting exercise. Moreover, the screening tool allows communities to begin to evaluate the aggregate exposure to single chemicals that have multiple sources in a local area and to consider cumulative effects by identifying multiple chemicals that have similar effects. The tool is designed to provide information in a relatively short time with limited resources. Use of the risk screening method allows communities to avoid the costly and time-consuming analysis of a full risk assessment,

while providing enough risk information to help a community build consensus on priorities for improving air quality.

Because the information provided by a risk screening analysis of this kind is limited, a special effort must be made to explain the uncertainties and limitations to the public. Without the proper level of educational effort, the risk screening tool could easily be misunderstood for a risk assessment, and conclusions could be mistakenly drawn that are not supported by the analysis. This is an inherent limitation of this risk screening analysis that must be taken into account. The narrow scope of the risk screening focuses on pollution sources to the ambient air, excluding other important areas of environmental risk in the community such as indoor air. It is important for the community to understand that the study on which this report is based examined only certain types of sources and only from the inhalation pathway. Other media (e.g., contaminated soil, drinking water, lead paint, etc.) and exposure routes should be taken into consideration. A special effort to place the screening results in a wider context of environmental risks is important to the proper use of this screening methodology, and may help avoid confusion and misplaced priorities.

The Methodology Helps Facilitate the Mobilization of Local Resources to Make Improvements in Local Air Quality

The results of the risk screening methodology used in Baltimore include more than technical facts about chemical risks that were determined using the screening tool. The methodology also incorporates a collaborative process that can result in better approaches to building community consensus and can mobilize community resources around concrete actions. These benefits come from the work that is required to build a partnership and to conduct the screening exercise. The Partnership attempts to bring all the sectors of the community together, including governments, and provides a forum for dialogue on air quality issues. It encourages the communication of information and perspectives among different sectors of the community and sets the stage for the development of a community consensus. The technical screening process itself provides a framework for the discussion of all the important air quality issues, as well as the relevant scientific methods that are involved. A thorough and careful discussion and understanding of hazard, exposure, modeling, and risk are essential to the success of the partnership approach. The methodology also emphasizes the need to ensure that all participants can participate fully in the process, maximizing the potential for consensus and for effective action. Overall, the methodology is designed to build the long-term ability of the community to understand and address air quality issues. As much as it is a technical screening tool, the methodology is also an educational process designed to make the best information and science available to the community.

Because the educational and capacity-building approaches are essential to this methodology, implementation requires the commitment of appropriate resources. The technical screening exercise can be done relatively quickly, but the accompanying education of both the Committee and the broader community will take time and resources. This process cannot be shortened if consensus and community mobilization are the goal of the process.

The Technical Aspects of Screening Methodology Need Further Refinement

- Addition of mobile source modeling. The Baltimore exercise focused on stationary and area sources. This task will expand capacity of methodology to include mobile source modeling.

- Review and improvement of source inventory review. Review existing source inventories to identify additional sources of emissions to ensure that all significant sources are included.

- Identification of best source for toxicity data. Compare available toxicity databases to identify most accessible and complete source of data for community screening exercise.

- Expansion of screening methodology to include short-term acute effects.

- Review of screening calculations to determine if they are appropriate for and protective of sensitive and urban populations.

- Development of a method to screen for cumulative exposures in the initial screening step.

- Expansion of methodology to include indoor air risks, to provide a more comprehensive picture of air risks.

- Incorporation of GIS mapping to enhance the communication of the modeling and screening results.

Specific Lessons Learned for Each Step of the Screening Methodology

Step 1, Lessons Learned: Built Partnership, Clarified Goals, Developed Outreach Plan

1. *Clarify Expectations About the Results of the Project from the Start.* It is important to clearly explain in detail what the project will and will not be able to accomplish. The limitations of the work must be completely understood, and the participants must agree that the results are worth the effort they will be making. Pay special attention to explaining that the information provided by the screening exercise will need to be combined with other information to effectively address public health concerns. Also, pay special attention to clarifying the difference between regulatory enforcement and voluntary pollution prevention actions.

2. *Clarify the Roles of All Participating Partners Before Starting.* While participants will need to be flexible to meet unforeseen circumstances, clarifying and agreeing on roles up front will

help communication. Participating governments should draft a Memorandum of Understanding (MOU) clearly outlining the known project tasks and responsibilities. The process of approving the MOU will give each participating government organization the opportunity to ensure that enough resources are assigned to the project. An MOU of some kind for all the partners may be helpful.

3. *Choose Government Staff Trained in Outreach and Community Work To Staff the Partnership Working Committee.* Technical staff who lack community outreach training should work with skilled community outreach staff. It is recommended that further training be provided to government staff on multimedia and other technical approaches relevant to community environmental concerns.

4. *Establish a Set of Minimum Partnership Representation Requirements That Need To Be in Place before Beginning a Project.* Make sure there are enough willing partners from each sector of the community who agree with the process and will work in a partnership with a broad range of stakeholders. All partners also must be committed and willing to work toward a consensus. Everyone will have personal agendas, but partners must be willing to work with others to try to find common ground. Representation from the different partners should be broad, reflecting as many community viewpoints as possible. Do not rely on a single group or organization to represent the community or businesses. If the minimum requirements cannot be met, it is better to postpone the project until broader participation can be developed, because the problems created down the road are likely to make the work ineffective.

5. *Resources Must Match the Capacity of the Community Where the Project Is Located.* If a strong community infrastructure with representation from all sectors of the community already exists, few resources will have to be devoted to building a partnership. Communities lacking strong civic infrastructures will require considerable time and resources to develop the necessary starting point for a successful project.

6. *Work on Trust-Building at the Start and Throughout the Project.* The partnership will bring together a broad representation of the community and governments. Trust will be an issue. This should be brought into the open and dealt with from the beginning. It will also reappear, especially when difficult issues or decisions must be made, so attention must be paid to building trust throughout the project.

7. *Establish Ground Rules That Reflect the Nature of the Partnership and Show Respect for the Process.* Discussion of these ground rules will provide the key ingredients for trust-building and the ability to complete work in an open and cooperative manner. Ground rules will provide an easy reference at difficult parts of the process.

8. *Get an Independent Facilitator for the Start-up Process and Working Meetings.* It is very important that someone skilled in facilitating partnerships be assigned to the group to pay

attention and to make sure the process is working. The facilitator should understand the content of the work but should be focused on process, making sure everyone participates equally, meetings are run and organized well, issues of trust are dealt with, etc. It is not possible to participate fully in the content of the working meetings and facilitate the process at the same time. Facilitators can be paid or volunteer and can be found locally, such as a local school principal or minister, or can come from outside the community from organizations such as the National Civic League.

9. *Set a Minimum Participation Level for Committee Legitimacy for Each Sector of the Community and Establish It As a Necessary Quorum for Meetings.* If the quorum is not met, then the committee should shift its emphasis to recruitment.

10. *From the Beginning of the Project, Identify Some Issues That Everyone Can Agree on and Organize Small Actions To Make Progress on These Issues.* Mixing action with screening work will help avoid the feeling some will have of never actually doing anything but meeting. It will also establish the Committee in the community and set the stage for better communication. The Committee can learn more through action and can recruit new members, if necessary. Taking action on asthma by setting up workshops through area Parent Teacher Associations (PTAs) is an example of an action that the Committee could adopt.

Step 2, Lessons Learned: Built Source Inventory Database

1. *Include the Means To Estimate or Collect Data on Emissions from Mobile Sources.* Mobile sources were not addressed in the Baltimore exercise primarily because the focus was on commercial, industrial, and waste treatment and disposal sources. Since mobile sources contribute significantly to air pollution, future efforts should consider modeling or measuring emissions from mobile sources.

2. *Investigate Existing Urban Source Inventories To Determine the Best Inventory To Use for the Screening Methodology.* The Baltimore methodology included point and area sources. Other sources may need to be added.

3. *Consider the Types of Emission Information Needed for the Screening Exercise As Soon As Possible After the Project Begins.* Information entered into a database from the onset of the process is much easier to handle and organize than hard copies of information that have to be physically manipulated.

4. *Set up a Personal Computer in a Central Location.* Having it set up in a community center or office will give all participants easy access to the data. Provide training on data entry and database use and maintenance. Investigate possibilities of accessing the database via Internet or other forms of live data sharing.

5. *Create Fields in the Source Inventory Database To Identify the Data Source for Each Entry, (e.g., from TRI or from the state permitting database).* This is especially useful for determining the most appropriate value when multiple values exist, and for quality control purposes.

6. *Routinely Update the Database.* Emission data and other information are likely to change over time. As new information becomes available, trained personnel should be available to periodically make the relevant changes.

7. *Use Residents, Local Industry, and Government Representatives as Valuable Resources To Verify the Location and Operational Status of Facilities.* A modest investment in equipment such as a geographic positioning system (GPS) unit, laser range finder, and U.S. Geological Survey (USGS) topo maps can significantly increase the accuracy of air modeling inputs such as facility location.

8. *Use State Air Toxics Studies Where Available.* These documents may contain valuable information that can be useful in conducting risk screening exercises such as data monitoring, emission estimates, facility information, and assessment methodologies.

9. *Save Significant Time and Effort by Designing Electronic Forms To Collect Various Types of Information.* These forms can be transferred via e-mail and should be designed to be compatible with the format of the emission inventory. In the case study, information on the facilities' stack parameters was collected by hand on hard copy forms and entered into the emission inventory database. Electronic forms would have allowed this information to be transferred directly into the database.

Step 3, Lessons Learned: Conducted Initial Screening

1. *Identify All the Key Decision Points in the Screening Exercise and Get Clear Committee Decisions on These Issues Before Starting the Exercise.* Focus especially on the decisions for choosing screening values and their relationship to the purpose of doing the screening exercise.

2. *Make a Special Effort To Provide the Necessary Background Information for Nontechnical Members of the Committee, Including Training, To Ensure That All Committee Members Fully Understand the Science of the Screening Process Prior to Step 3.* The screening meetings will be fairly technical and should be conducted with careful preparation and good facilitation. Such meetings should be held either by a subgroup that reports to the full Committee, or by the full Committee. These screening meetings should be open and residents should be encouraged to attend. Translation of the technical language (e.g., using outreach materials to make sure the community at large understands the process) should be provided for the nontechnical participants.

3. *Keep Detailed Records of the Decisions Made and the Reasons for the Decisions.* All steps of the screening process should be well documented for review by any interested community members.

4. *Be Thorough with the Review.* Given the level of detail and the amount of information, it would be better to hold two screening decision meetings. The first meeting should focus on identifying missing information and familiarizing each person with the process. The second and final decision meeting can then be more thorough and all points of view can be considered. Of critical importance is the gathering of toxicity information for the risk calculations. The database should be as complete as possible so the risk calculations can be made. This will ensure that all chemicals of concern to the community will be identified in the screening exercise.

5. *Develop and Carry Out a Quality Assurance Method To Ensure That No Inadvertent Errors Were Made in the Screening Exercise.* All data entries and calculations should be checked for accuracy. This quality control can be designed so that it does not cause too much of a delay in the work. Perhaps a local college or university can provide quality assurance as a class project.

6. *Prepare a Summary of the Decision Meeting(s) and Provide Outreach Materials to the Community Explaining the Decisions Immediately.* Keep the community informed as the screening process proceeds. This will start the information transfer to the community and give the Committee practice in explaining the process, strengths, and weaknesses.

7. *Review All the Assumptions of the Screening Process, Including the Generic Turner and ISC Modeling Methods to Determine if Adjustments Are Needed To Protect Children and Other Sensitive Populations in the Community.*

8. *Develop a Formal Method for Evaluating Potential Cumulative Exposures in the Initial Screening Step.* For the initial screening step, the Partnership Air Committee informally reviewed chemicals with multiple sources to determine if the combination of sources would reach the 10^{-6} cancer risk screening value.

9. *Try To Make Background Information and Training Available To Ensure That All Committee Members Fully Understand the Views of Each Member and the Science of the Screening Process Prior to Step 3.* This will take time, careful preparation, and good facilitation of Committee meetings. The Committee should summarize this exchange of information and prepare outreach materials to make sure the community at large has the benefit of this information.

10. *Develop a Common Interpretation of the Modeling Information and Communicate This Information to the Community at Each Stage/Step of the Process.* The screening process should not move forward until the Committee can reach agreement on any issues related to modeling and until community outreach materials are prepared.

Step 4, Lessons Learned: Conducted Secondary Screening

1. *At This Stage of the Screening Exercise, Avoid Using Actual Concentration Numbers in the Presentation of the Screening Results.* Using real numbers may create the impression that the screening analysis is more exact than warranted. The estimation of emissions and the uncertainties of the modeling used at this stage of the screening exercise are better expressed simply as "above" or "below" the screening level. The screening is designed to eliminate chemicals with some confidence, but those found to remain above the screening level need further information before any conclusions can be drawn about potential effects.

2. *Examine the Assumptions That Go into the Calculation of the Region 3 Risk-Based Concentration Tables (or other sources for risk-based concentrations).* Revisit assumptions for future screening exercises to ensure they are protective of sensitive populations and appropriate for urban ambient air screening.

3. *Develop and Review Further the Method for Grouping Chemicals wth Similar Effects To Estimate Cumulative Effects.*

4. *Keep Detailed Records and Check All Steps for Accuracy.*

Step 5, Lessons Learned: Conducted Final Screening

1. *Maintain Careful Record of the Information Provided by the Facilities in the Final Screen and Check for Accuracy.* A clear documentation of the differences between the secondary and final screenings will be important.

2. *If There Is a Monitoring Station In or Near the Project Area, Consider the Location of the Monitoring Station as One of the Model Outputs so Comparison of Monitored and Modeled Concentrations Can Be Facilitated.*

3. *If Possible, Verify Modeling Results with Monitoring for Validation.*

4. *Keep Detailed Records and Check All Steps for Accuracy.*

Step 6, Lessons Learned: Recommendations and Communication

1. *Engage the Committee in the Preparation of Communication Materials That Explain the Scope and Limits of the Exercise at the Beginning of the Process Before the Results Are In.* This will help everyone on the Committee to understand what will and will not come from the exercise. The early preparation of communication materials will also help to ensure that a gap does not exist between the time when the Committee gets the results of its screening exercise and the communication of those results to the community. This gap allows individuals to present their own interpretation of results to the community before the Committee has a chance to communicate the view of the Committee consensus.

2. *Establish Outreach Goals As a Core Committee Task.* The Committee should combine community outreach and information collection as equal goals. The Committee should devote approximately equal time to outreach and screening throughout the project.

3. *Develop Outreach Materials and Communicate to the Community at Each Stage of the Screening Process, Not Just at the End of the Exercise.* Communicate regularly to the community during the course of the screening exercise, perhaps in the form of a newsletter, press releases, and presentations to small community groups. This will develop the communication skills of the Committee and help to avoid the problem of having to learn how to communicate everything when the results come in. Meetings focused on screening and outreach should alternate, with the Committee providing constant updates and education on the work to the community. Please see the amended flow chart (Figure 7) for the screening methodology that incorporates this lesson. This flow chart presents community outreach and input, providing a more complete picture of the methodology than the flow chart presented in the Introduction.

4. *Communicate Regularly to the Press So They Understand the Process and Are Prepared To Help with Communication to the Public.*

5. *Present the Results of the Risk Screening in as Broad a Context as Possible so the Community Has the Information To Set the Most Effective Priorities.* Consider providing information on areas such as mobile sources and indoor air so that the community has as complete a picture of air risks as possible.

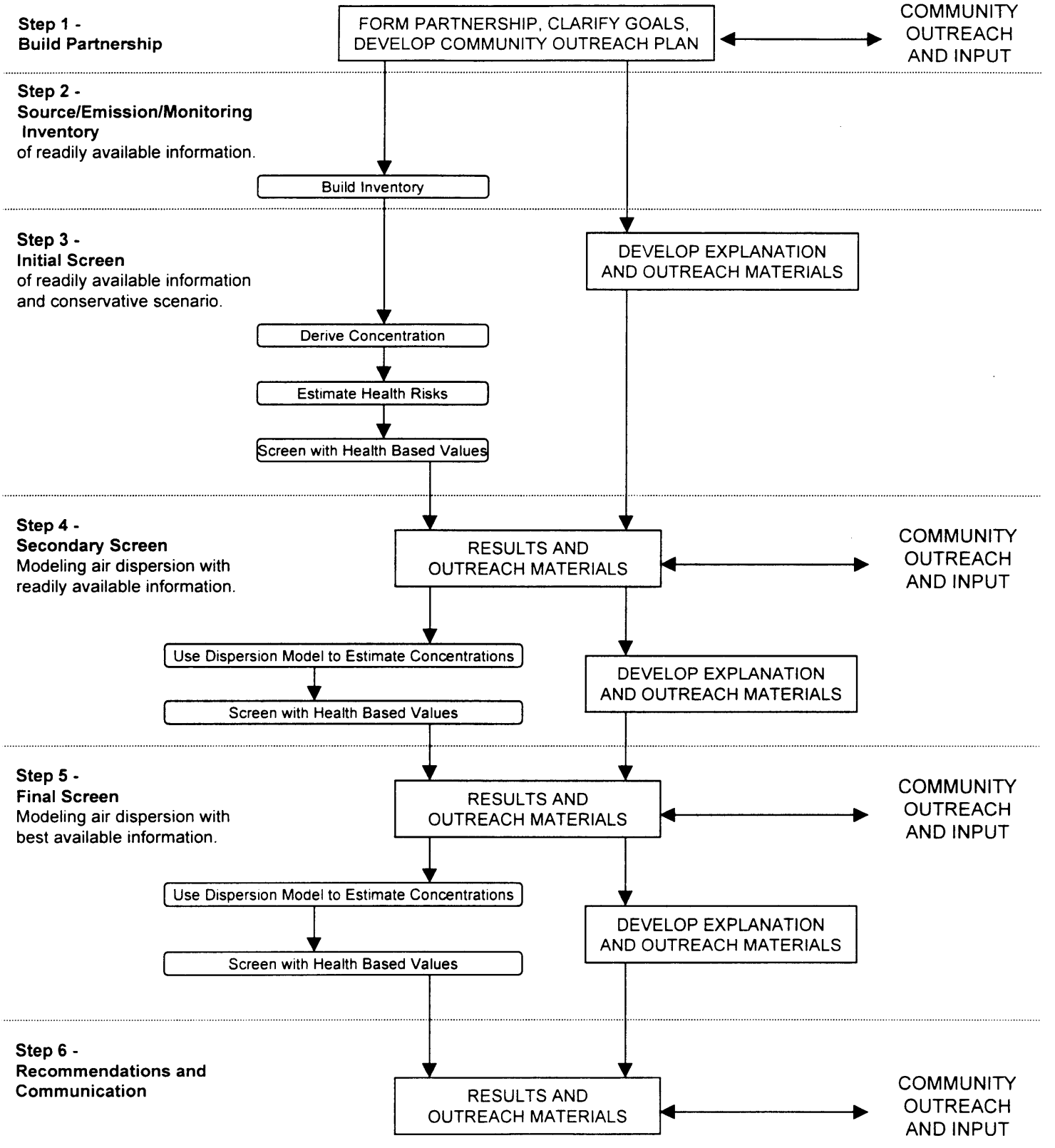


Figure 7. Generic Air Screening Methodology for the Community

REFERENCES

DHHS, 1994. Annual report on carcinogens. Prepared by National Toxicology Program (NTP), U.S. Public Health Service, Department of Health and Human Services, RTP, NC.

National Research Council (NRC). 1983 Risk assessment in the federal government: Managing the process. Committee on the Institutional Means for Assessment of Risks to Public Health, Commission on Life Sciences, NRC. Washington, DC: National Academy Press.

SAI. 1999. Modeling Cumulative Outdoor Concentrations of Hazardous Air Pollutants. Revised Final Report. SYSAPP-99-96/33r2. Systems Applications International, Inc. February 1999.

Turner, D. 1994. Workbook of atmospheric dispersion estimates: an introduction to dispersion modeling. Second edition. Boca Raton, FL.: CRC Press.

U.S. EPA, 1999a.. Framework for Community-Based Environmental Protection; EPA 237-K-99-001. Office of Policy/Office of Reinvention. February 1999.

U. S. EPA, 1999b. Chicago Cumulative Risk Initiative (CCRI). Website: http://www.epa.gov/reg5oopa/agenda99/goal_8.htm

U. S. EPA, 1999c. Cumulative Exposure Project. Website: http://www.epa.gov/cumulativeexposure/air/air.htm

U.S. EPA, 1999d. National Air Toxics Program: Integrated Urban Strategy. Website: http://www.epa.gov/ttnuatw1/urban/urbanpg.html

U.S. EPA, 1999e. Integrated Urban Air Toxics Strategy. 64 FR 38705. July 19, 1999. U.S. EPA Office of Air Quality Planning and Standards. Final Urban Air Toxics Strategy.

U.S. EPA. 1998. Science Policy Council Handbook on Peer Review. Office of Science Policy. EPA 100- B- 98- 001. January 1998. Website: http://www.epa.gov/ordntrnt/ORD/spc/prhandbk.pdf

U.S. EPA, 1997a. Facility Index System (FINDS). Website: http://www.rtk.net/www/data/fin_gen.html & Data Universal Numbering Sytem (DUNS) Website: http://www.epa.gov/envirofw/html/finds/duns_num_co.html

U.S. EPA, 1997b. Toxic Release Inventory (TRI). Website: http://www.rtk.net/www/data/tri_gen.html

U.S. EPA, 1997c. Aerometric Information Retrieval System Air Quality Subsystem (AIRS/AFS) data base. Office of Air and Radiation. Washington, DC. Website: http://www.epa.gov/ttn/airs/afs/index.html

U.S. EPA, 1997d. EPA Region III Risk-Based Concentration Table (RBC Table). Website: http://www.epa.gov/reg3hwmd/risk/riskmenu.htm

U.S. EPA, 1997e Integrated Risk Information System (IRIS). Website: http://www.epa.gov/docs/ngispgm3/iris/index.html

U. S. EPA, 1997f. Health Effects Assessments (HEAST) Summary Tables. FY 1997 Update. EPA-540-R-97-036. July 1997.

U.S. EPA. 1996. Proposed Guidelines for Carcinogenic Risk Assessment. EPA/600/P-92/003C. Office of Research and Development. National Center for Environmental Assessment. April 1996.

U.S. EPA, 1995. Users guide for the industrial source complex (ISC3) dispersion models. Office of Air Quality Planning and Standards (OAQPS) Emissions, Monitoring, and Analysis Division, RTP, NC. Website: http://www.epa.gov/ttn/scram

U.S. EPA. 1992a. Guidelines for Exposure Assessment. EPA/600-Z-92/001. FR57:22888-22938, May 29, 1992.

U.S. EPA, 1992b. A Tiered Modeling Approach for Assessing the Risks Due to Sources of Hazardous Air Pollutants. U.S. EPA Office of Air Quality Planning and Standards, Research Triangle Park, NC. EPA-450/4-92-001. March 1992.

U.S. EPA. 1989. Risk Assessment Guidance for Superfund, Volume I. Human Health Evaluation Manual (Part A). EPA/540/1-89/002. Interim Final, December 1989. Website: http://www.epa.gov/oerrpage/superfund/programs/risk/ragsa/index.htm

U.S. EPA, 1987. Guideline on Air Quality Models (Revised) U.S. EPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC. EPA-450/2-78-027R.

APPENDIX A

List of Community Environmental Partnership (CEP) Air Committee Members

REGULAR AIR COMMITTEE MEMBERS

NAME	ORGANIZATION
Richard Anderson	Concerned Citizens for a Better Brooklyn (CCBB)
Caroline Bahr	Enoch Pratt Library
Delores Barnes	Concerned Citizens for a Better Brooklyn (CCBB)
Rebecca Besson	Delta Chemical Corp.
John Besson	Delta Chemical Corp.
Ann Bonenberger	Concerned Citizens for a Better Brooklyn (CCBB)
Clarice Brown	Southern Neighborhood Service Center
Peter Conrad	Baltimore City Planning Department
Francis Croft	Sierra Club
Ruben Dagold	Baltimore City Health Department
Stephen Dyer	Grace Davison
Steve Farkas	Baltimore Gas & Electric (BGE)
Randy Gaul	Resident
Matt Gillen	U.S. EPA
Terry Harris	Sierra Club
Reginald Harris	U.S. EPA
Albert Hayes	U.S. EPA
Ed Looker	Resident
David Lynch	U.S. EPA
*Dave Mahler	Condea Vista
*Doris McGuigan	Ministerial Alliance/Maryland Waste Coalition
Richard Montgomery	Phoenix Services
Allen Morris	CITGO
Charles Nardiello	Arundel Corporation
William Paul	MDE/ARMA
John Quinn	Baltimore Gas & Electric (BGE)
Rev. R. Andrews	Brooklyn United Methodist Church
Pars Ramnarain	MDE/ARMA
Hank Topper	U.S. EPA
Don Torres	Baltimore City Health Department
Michael Trush	Johns Hopkins School of Hygiene & Public Health

* Co-Chairs

APPENDIX B

Letters from Partnership

CLEANUP COALITION

July 14, 1998

The Honorable Lynn Goldman
Assistant Administrator
U.S. EPA
401 M St. SW
Washington, D.C. 20642

Michael McCabe
Regional Administrator
U.S. EPA
841 Chestnut Building
Philadelphia, PA 19107

Re: Environmental Partnership Program in South Baltimore

Dear Mr. McCabe and Ms. Goldman:

We are writing with regret to inform you that after two years and many hours of work, we have decided that we can no longer participate in the Environmental Partnership Program in South Baltimore. We count ourselves among the founders of this important project and we have reached this conclusion only after considerable deliberation and a sincere effort to salvage this troubled effort. We explain our reasons in some detail below, in the hopes that they will help EPA redesign similar initiatives.

We began this process deeply committed to the Partnership's ultimate goal: the discovery of more effective ways to reduce pollution through the reinvention of traditional regulatory programs. But along the way, after countless meetings where we tried repeatedly to pursue that objective, it became clear to us that other participants in the Partnership Program did not share this goal, but rather saw the effort as a vehicle for pursuing their own agendas. EPA, as the convener of this effort, must bear the responsibility for allowing this dissension to fester, never effectively leading the group to reach consensus on the overall purpose of the Partnership.

All of us have far too many opportunities to sit in rooms with people who disagree with us, arguing endlessly about who is right. We long ago learned the pat positions of our opponents and developed our own automatic responses. What we need -- and what we thought we would get from the Partnership when we first signed on -- was a real opportunity to get beyond rhetoric to results, developing a new and deeper understanding of the environmental conditions that threaten us and debating the best way to address those problems.

107 Scott St.*Baltimore, MD 21201*410 625 0559

The final straw came at the last meeting of the Air Subcommittee. Industry representatives, who at this point outnumber public interest representatives by a margin of three to one, informed us at great length that there is no serious pollution problem in South Baltimore and certainly no evidence that public health is suffering as a result of environmental contamination, as opposed to the individual lifestyle choices of our families, friends, and neighbors. In short, we were told that our concerns are fanciful and that we are sick because we smoke and drive automobiles. Life is just too short to spend being hectored in this manner.

The only redeeming feature of that meeting was a statement made by Reginald Harris, the EPA Region III representative to the Partnership. Mr. Harris made an effort to explain to our opponents why their arguments were unjustified and counterproductive. But this intervention, as much as we appreciated it, came too little and too late.

As we wrote you a year ago, the Environmental Partnership Program in South Baltimore failed for three distinct reasons: 1) the absence of tangible and specific goals and milestones; 2) a process that erects high barriers to effective citizen participation; and 3) a profound and systematic failure to communicate effectively by EPA line staff. Before you begin a similar effort elsewhere in the country, we hope that you will carefully consider these comments and not just move on, finding another group of unsuspecting citizens to participate in such a pointless exercise.

Sincerely,

Doris McGuigan
Maryland Waste Coalition
Cleanup Coalition

Terry Harris
Sierra Club
Cleanup Coalition

Ann Bonenberger
Maryland Waste Coalition
Concerned Citizens for a Better Brooklyn
Cleanup Coalition

Rose Hindla
Fairfield/Wagner's Point Neighborhood Coalition
Cleanup Coalition

Dru Schmidt-Perkins
League of Conservation Voters
Cleanup Coalition

Dan Pontious
MaryPIRG
Cleanup Coalition

cc: Senator Barbara Mikulski, Senator Paul Sarbanes, Governor Parris Glendening, Congressman Wayne Gilchrest, Senator George Della, Delegates Timothy Murphy and Brian McHale, Mayor Kurt Schmoke

Administrator Carol Browner, Deputy Administrator Fred Hansen, MDE Secretary Jane Nishida, EPA Division Director William Sanders, EPA Region III representative Reginald Harris

The Southern Baltimore & Northern Anne Arundel County
Community Environmental Partnership
Working Together to Improve our Communities
3606 Hanover Street Baltimore, MD 21225

The Honorable Lynn Goldman
Assistant Administrator
U.S. EPA
401 M St.. SW
Washington, D.C. 20542

Michael McCabe
Regional Administrator
U.S. EPA
841 Chestnut Building
Philadelphia, PA 19107

September 11, 1998

RE: Environmental Partnership in South Baltimore

Dear Mr. McCabe and Ms. Goldman:

This letter is a response to the July 14, 1998 letter from the Cleanup Coalition announcing their withdrawal from the Community Environmental Partnership Air Committee. We are concerned about this most recent attack on our organization, and we want you to know that those of us who are committed to the Partnership far out number the handful of Partnership members who signed the letter. Three of the individuals who signed the letter have never attended a meeting or been involved in the Partnership in a significant way. We are afraid that these individuals represent groups with an agenda to discredit the efforts of partnerships among residents, businesses and government officials. It appears to us that the Cleanup Coalition, despite their worthy goals, is more accustomed to maintaining an adversarial approach than to achieving positive results for the community. When positive and effective efforts like ours do not come up with results that support their adversarial approach, their only option seems to be to withdraw and write a letter. The approach of working together to create a win-win situation seems foreign to their way of thinking.

Both the current letter and last year's letter criticizing our Partnership were timed to appear on the day before our Air Committee was scheduled to finalize reports for the community. This is clearly not a coincidence. The members of the Cleanup Coalition appear to be willing to try to block the distribution of information important for our community's health. Their involvement in the process up to the finalizing of the committee's most recent report tends to discredit their current position. Perhaps they are opposing the report because the results do not appear to support their organizational agendas..

Members of the Cleanup Coalition are continuing their opposition to the new approach we have taken in the Community Environmental Partnership. We have tried to go beyond the adversarial approach and to build a partnership among all the sectors of our community. We are concerned about the continuing opposition to this approach. Such opposition makes it difficult for us to focus on positive community improvements. Valuable time and efforts has been spent responding to these concerns. We would like to be able to focus more upon building a stronger partnership that will help our community.

These are the facts about the Partnership:

The Partnership Air Committee and its draft report, contrary to the claims made, does not target individual life styles or blame community members for their health problems. The Partnership Air Committee has not, as claimed, spent endless hours in a wasted effort.

The Committee has completed one of the most comprehensive reviews of stationary source releases ever attempted and it has accomplished this with the voluntary participation of all sectors of the community. The Air Committee succeeded in pulling together a vast amount of information and has succeeded in answering questions about local air quality that the community has been asking for many years. The results of this work will give us a chance to be much more effective in targeting our ongoing efforts to improve the health of our community.

The three members of the Cleanup Coalition who participated in the Partnership worked with this committee and agreed with all of its major decisions up until their recent decision to withdraw.

The Partnership has harnessed a tremendous amount of volunteer effort to improve our communities. We have had hundreds of school children and parents participate in two major park clean ups and educationals.

We have had volunteer committee members spend countless hours working with state and federal officials to collect and interpret vital environmental information for the community.

The Partnership has organized pollution prevention, tenant rights, Internet and computer training, workshops on asthma, ozone, green business, it has continued positive efforts with Congressman Wayne Gilcrest to pursue a wildlife reserve in the area, and more recently has begun to help local residents find temporary employment.

The Partnership has succeeded in bringing a very broad range of organizations and individuals together to work in our communities. We have brought MDE, DPW, EPA, Johns Hopkins School of Public Health, University of Maryland School of Social Work, Chesapeake Bay Foundation, Save our Streams, Millennium, Chem Metals, FMC, Delta Chem, BFI, 4 H, Civic Works, hundreds of local middle, elementary and special educational and vocational children and their parents, Brooklyn Homes Tenants Association, the Police Athletic League, and others–all working together to find constructive solutions to community problems.

The Partnership has begun a major project to create a wildlife preserve and education center for our communities on the north Brooklyn shore. This project could help change the reputation of our neighborhoods and give our Region a priceless natural resource.

The Partnership has brought residents and industry together and opened up a broad community dialogue on important issues.

The Partnership has created an unprecedented partnership of City, County, State, and Federal governments and brought this partnership into the community to help us answer questions and solve problems. This has given us a rare chance to work side by side with our government agencies.

We hope that this partial list will convince you that our Partnership is doing importa work, or, at least, convince you to find out more about us. We are determined to continue and to bu on the work we have begun. We are proud of what we have accomplished and we are excited about our uture plans. If you have any questions about our work, we encourage you to please take the time to find out as much as you can about our Community Environmental Partnership. We would like to schedule a meeting with you to further discuss our activities and plans. If you can't visit us, please give us a call at 410-354-0352.

Thank you for your support

Sincerely,

Executive Committee
Rev. Rick Andrews, Wanda Grimes, Dan Butler

cc: Senator Barbara Mikulski, Senator Paul Sarbanes, Governor Parris Gendening, Congressman Wayne Gilchrest, Senator George Della, Delegates Timothy Murphy and Brian McHale, Mayor Kurt Schmoke

Administrator Carol Browner, Deputy Administrator Fred Hansen, MDE Secretary Jane Nishida, EPA Division Director William Sanders, EPA Region III representative Reginald Harris

APPENDIX C

Sources for Facility Information

- **Envirofacts**
  - **TRI**
  - **FINDS (includes Dun & Bradstreet Numbers)**
  - **AIRS/AFS**

Envirofacts

Envirofacts Database:

Website Address: http://www.epa.gov/enviro/index_java.html

This website provides access to several EPA databases that provide you with information about environmental activities that may affect air, water, and land anywhere in the United States. The Environmental Protection Agency (EPA) created the Envirofacts Warehouse to provide the public with direct access to the wealth of information contained in its databases. The Envirofacts Warehouse allows you to retrieve environmental information from EPA databases on Air, Chemicals, Facility Information, Grants/Funding, Hazardous Waste, Risk Management Plans, Superfund, Toxic Releases, and Water Permits, Drinking Water, Drinking Water Contaminant Occurrence, and Drinking Water Microbial and Disinfection Byproduct Information (Information Collection Rule [ICR]). You may retrieve information from several databases at once, or from one database at a time. Online queries allow you to retrieve data from these sources and create reports, or you may generate maps of environmental information selecting from several mapping applications available through EPA's Maps On Demand.

You can also read about the spatial data used by the Maps On Demand mapping applications. The Locational Reference Tables contain all of the latitude and longitude coordinate information available through Envirofacts.

TRI

Toxics Release Inventory


Area TRI Report


Facility TRI Report


Industry TRI Report


Parent TRI Report


Offsite Transfer TRI Report

The Toxic Release Inventory (TRI) is a database of information about releases and transfers of toxic chemicals from manufacturing facilities. Facilities must report their releases of a toxic chemical to TRI if they fulfill four criteria:

1. They must be a manufacturing facility (primary SIC code in 20 -39);
2. They must have the equivalent of 10 full-time workers;
3. They must either manufacture or process more than 25,000 lbs of the chemical or use more than 10,000 lbs during the year;
4. The chemical must be on the TRI list of 350 specific toxic chemicals or chemical categories.

Therefore, not all, or even most, pollution is reported in TRI. However, T RI does have certain advantages:

1. It is multi-media. Facilities must report the amounts they release to air, land, water, and underground separately, and must report how much they send off-site;
2. All quantities are reported in pounds. This is an advantage compared to databases like PCS, which often report releases as concentrations, or other databases which report releases by volume of waste. These measures are often impossible to convert into pounds;
3. It is congressionally mandated to be publically available, by electronic and other means, to everyone. This means that it's relatively easy to obtain TRI data and that the data is well-known, becoming a national "yardstick" for measuring progress in pollution and waste generation.

The TRI data is reported by individual facilities, who send their reports to Federal EPA every year. These reports are filled out on a form called "Form R". EPA takes these forms and converts them into an electronic database . To better understand TRI data, it is recommended that you order a copy of one of these forms from the TRI Hotline (1-800-535-0202). You can also order (for free) a national "data release", or summary on paper, of TRI data every year from the Hotline.

FINDS (including Dun & Bradstreet)

FINDS Facility Index System


Area FINDS Report


Facility FINDS Report


Industry FINDS Report

FINDS data is a comprehensive listing of facilities regulated under a variety of EPA programs. The FINDS database provides some basic information about each facility and a listing of its ID numbers in other EPA databases. With these ID numbers, you know where to look for more information (if you can somehow get access to the other EPA databases.)

FINDS has both master records and alias records. A master record describes the most accurate information for a facility that is known to EPA. An alias record describes information for a facility as it appears in another EPA database. A single facility will have one master record and one or many alias records in FINDS.

The program will search both the master and alias records, unless you search specifically using a source program type in the Area report. Low detail searches will display only the master records; High detail adds the alias records. All that will be retreived in any case is the facility's name, address, and a few other identifiers -- that is all that is in FINDS.

Attribute: DUNS_NUM_CO

Definition:

The Data Universal Numbering System (DUNS) value which uniquely identifies a corporate entity.

This attribute is the primary key for the FND_COMPANY and FND_DUNS_SIC_CODE entity types and is the foreign key for the FND_FACILITY entity type.

Definition Source:

FINDS 4.0 Data Element Dictionary, September 22, 1994.

Security: Public

Source System: FINDS

- FINDS Table: FINDS_FACILITY_ALL
- Element: DUNS_NUM_COMPANY

Last Updated: 03/31/95

Remarks: ***The data in the FND_COMPANY and FND_DUNS_SIC_CODE tables is only available to those EPA users who have access to the internal Envirofacts database. Access to the data in this table is restricted to EPA users due to the Agency's licensing agreement with Dun and Bradstreet. The information about this attribute is provided for the use of the EPA users who wish to query the system. Outside users will not be able to access this table and will see an error message when they try to access this table.***

Properties: Mandatory Basic Text

- Length: 9
- Default: None.

Return to:

- FINDS Entity & Attribute Information
- Envirofacts Overview

AIRS/AFS

EPA United States Environmental Protection Agency

Office of Air Quality Planning & Standards OAQPS

TTNWeb Technology Transfer Network

AIRS Aerometric Information Retrieval System

Welcome to AIRS TTN

The Aerometric Information Retrieval System (AIRS) TTN web site is designed to provide technical information about the AIRS data management system primarily to AIRS users (state and local agency management, EPA Regional Offices, consultants, and environmental groups.)

We encourage you to visit the What's New page to learn about current happenings and events.

Main Table of Contents

This site is maintained by the Information Management Group (IMG) of theInformation Transfer and Program Integration Division (ITPID), Office of Air Quality andPlanning & Standards, US Environmental Protection Agency (US EPA).

EPA United States Environmental Protection Agency

Office of Air Quality Planning & Standards OAQPS

TTNWeb Technology Transfer Network

AIRS Aerometric Information Retrieval System

AIRS Facility Subsystem (AFS)

AFS contains emissions, compliance and permit data for stationary sources regulated by the U.S. EPA and state and local air pollution agencies. This information is used by states in preparation of State Implementation Plans (SIPs), to track the compliance status of point sources with various regulatory programs, and report emissions estimates for pollutants regulated under the Clean Air Act.

This site is designed to keep users of the system apprised of developments. For general background information about AFS and AIRS, see AIRS Basic Facts. EXIT TTN

To generate reports of AFS data (major point sources), see the AIRS*Data* EXIT TTN page.

If you are a user of AFS and need technical assistance, call 1-800-367-1044 or email AFSHELPLINE@TRCCOS.COM

AFS Table of Contents

APPENDIX D

Toxicity Information

- EPA Region III Risk-Based Concentration Table
- MRLs (ATSDR)
- IRIS
- HEAST

EPA Region III Risk-Based Concentration Table

EPA United States Environmental Protection Agency **Region 3**

Hazardous Site Cleanup Division

RISK ASSESSMENT

- **EPA Region III Risk-Based Concentration Table - October 1998 Update** (*Some files are in Portable Document Format, PDF, and you will need a PDF reader. You may download a free copy from the Web, supplied by Adobe Software or use a Reader of your choice. This link to Adobe is only provided as a convenience to you, and does not represent a product endorsement. Using this option will cause you to leave the EPA web site. You may return to this page by navigating through the BACK button on your browser.)*

  Background Information
  Updated Risk Based Concentration Table Cover Memo

  RBC Table- PDFfile
  RBC Table- Self-extracting Lotus 123 file (54k)
  RBC Table- Self-extracting Lotus WK4 file (57k)
  RBC Table- Self-extracting Excel file (76k);

- Use of Monte Carlo Simulation in Risk Assessments

- Selecting Exposure Routes and Contaminents of Concern by Risk-Based Screening

- EPA Region III Guidance on Handling Chemical Concentration Data Near the Detection Limit in Risk Assessments

- Assessing Dermal Exposure fromSoil

[EPA Home | Region 3 Home | HSCD | Search Region 3 | Comments]

URL: http://www.epa.gov/reg3hwmd/risk/riskmenu.htm

This page last updated on December 24, 1998

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
841 Chestnut Building
Philadelphia, Pennsylvania 19107

SUBJECT: Risk-Based Concentration Table **DATE:** 10/1/98

FROM: Jennifer Hubbard, Toxicologist
Superfund Technical Support Section (3HS41)

TO: RBC Table Users

Attached is the EPA Region III Risk-Based Concentration (RBC) Table, which we prepare and post periodically for all interested parties.

IMPORTANT NOTES: To make the RBC Table more accessible and to minimize paper usage, it is now primarily available through the Internet. The address is **http://www.epa.gov/reg3hwmd/risk/riskmenu.htm**. The Table is available in both Lotus and Excel as "self-extracting" files. These files should be downloaded and then processed with your computer's "run" function. The files can then be viewed in Lotus or Excel. If you have technical questions about the toxicological or risk assessment aspects of the RBCs, please contact Jennifer Hubbard at 215-814-3328 or hubbard.jennifer@epamail.epa.gov. Other questions can be addressed to Vanessa Sizer or Terri Fields at 215-814-3041. You can also consult the Frequently Asked Questions, below.

CONTENTS, USES, AND LIMITATIONS OF THE RBC TABLE

The RBC Table contains Reference Doses (RfDs) and Cancer Slope Factors (CSFs) for 400-500 chemicals. These toxicity factors have been combined with "standard" exposure scenarios to calculate RBCs--chemical concentrations corresponding to fixed levels of risk (i.e., a Hazard Quotient (HQ) of 1, or lifetime cancer risk of 1E-6, whichever occurs at a lower concentration) in water, air, fish tissue, and soil.

The Region III toxicologists use RBCs to screen sites not yet on the NPL, respond rapidly to citizen inquiries, and spot-check formal baseline risk assessments. The primary use of RBCs is for chemical screening during baseline risk assessment (see EPA Regional Guidance EPA/903/R-93-001, "Selecting Exposure Routes and Contaminants of Concern by Risk-Based Screening"). The exposure equations come from EPA's Risk Assessment Guidance for Superfund (RAGS), while the exposure factors are those recommended in RAGS or supplemental guidance from the Superfund program. The attached technical background document provides specific equations

and assumptions. Simply put, RBCs are like risk assessments run in reverse. For a single contaminant in a single medium, under standard default exposure assumptions, the RBC corresponds to the target risk or hazard quotient.

RBCs also have several important limitations. Specifically excluded from consideration are (1) transfers from soil to air and groundwater, 2) cumulative risk from multiple contaminants or media, and (3) dermal risk. Additionally, the risks for inhalation of vapors from water are based on a very simple model, whereas detailed risk assessments may use more detailed showering models. Also, the toxicity information in the Table has been assembled by hand and (despite extensive checking and years of use) may contain errors. It's advisable to cross-check before relying on any RfDs or CSFs in the Table. If you note any errors, please let us know.

It is important to note that this Table uses inhalation RfDs and CSFs rather than RfCs and inhalation unit cancer risks. This is because the latter factors incorporate exposure assumptions and therefore can only be used for one exposure scenario. Because risk assessors need to evaluate risks for many types of scenarios, the factors have been converted to the more traditional RfDs and CSFs. Unless otherwise indicated in the toxicity-factor source, the assumption is that RfCs and unit risks should be adjusted by a 70-kilogram body weight and a 20 m^3/day inhalation rate to generate the RfDs and CSFs.

Many users want to know if the RBCs can be used as valid no-action levels or cleanup levels, especially for soils. The answer is a bit complex. First, it is important to realize that the RBC Table does not constitute regulation or guidance, and should not be viewed as a substitute for a site-specific risk assessment. For sites where:

1. A single medium is contaminated;

2. A single contaminant contributes nearly all the health risk;

3. Volatilization, leaching, dermal contact, and other pathways not included in the RBCs are not expected to be significant;

4. The exposure scenarios and assumptions used in the RBC table are appropriate for the site;

5. The fixed risk levels used in the RBC table are appropriate for the site; and

6. Risk to ecological receptors is not expected to be significant;

the RBCs would probably be protective as no-action levels or cleanup goals. However, to the extent that a site deviates from this description, as most do, the RBCs would not necessarily be appropriate.

To summarize, the Table should generally not be used to set cleanup or no-action levels at

CERCLA sites or RCRA Corrective Action sites, to substitute for EPA guidance for preparing baseline risk assessments, or to determine if a waste is hazardous under RCRA.

SPECIAL NOTES

The RBC Table was originally developed by Roy L. Smith, Ph.D., for use by risk assessors in the Region III Superfund program. Dr. Smith is no longer with Region III, and the Table continues to evolve. You may notice some modifications of formatting and conventions used in the Table.

For instance, besides formatting, the following changes are noteworthy:

- As usual, updated toxicity factors have been used wherever available. However, because IRIS and provisional values are updated more frequently than the RBC Table, RBC Table users are ultimately responsible for obtaining the most up-to-date values. The RBC Table is provided as a convenience, but toxicity factors are compiled from the original sources and it is those original sources that should serve as the definitive reference.

- Certain outdated and withdrawn numbers have been removed from the Table.

- BACK BY POPULAR DEMAND: Changes to the table have been marked with asterisks (**). This was the most commonly requested feature over the last six months. Changes may involve a corrected CAS number or a correction in the VOC status, or they may reflect changes of RfDs and CSFs on IRIS.

- RBCs are no longer rounded to 1E6 ppm. For certain low-toxicity chemicals, the RBCs exceed possible concentrations at the target risks. In such cases, Dr. Smith rounded these numbers to the highest possible concentration, or 1E6 ppm. The rounding has been discontinued so that Table users can adjust the RBCs to a different target risk whenever necessary. For example, when screening chemicals at a target HQ of 0.1, noncarcinogenic RBCs may simply be divided by 10. Such scaling is not possible when RBCs are rounded.

- This Table was originally compiled to assist Superfund risk assessors in screening hazardous waste sites. The large number of chemicals made the Table unwieldy and difficult to keep current. Many of the chemicals did not typically (or even occasionally) appear at Superfund sites. Starting with the April 1998 version of the Table, the 600+ chemicals were reduced to some 400-500 chemicals by eliminating many of those atypical chemicals. Through time, the Table may continue to grow or decrease in size. Comments on this issue are appreciated. During the last six months, only one request was received for restoration of a chemical: NuStar has been restored to the Table. (A list of the deleted chemicals is attached.)

- At Region III Superfund sites, noncancer RBCs are typically adjusted downward to correspond to a target HQ of 0.1 rather than 1. (This is done to ensure that chemicals with

additive effects are not prematurely eliminated during screening.) However, some chemicals have RBCs at HQs of 0.1 that are lower than their RBCs at 1E-6 cancer risk. In other words, the screening RBC would change from carcinogenic to noncarcinogenic. A new feature of this Table is that these chemicals are now flagged with a "!" symbol. Therefore, assessors screening with adjusted RBCs will be alerted to this situation.

- Earlier versions of this Table included a substitution of inhalation toxicity factors for oral factors whenever oral factors were unavailable (this applied only to groundwater and air, but not soil or fish). This practice has been discontinued in order to minimize the uncertainty associated with such a conversion. The discontinuation of this practice does not significantly decrease the number of available RBCs.

- CAS numbers and volatility status have begun to be re-checked in accordance with comments from users. At this time, 85% of the chemicals have been checked for volatility, and about 99% of the CAS numbers have been verified.

- Earlier versions of this Table included soil screening levels (SSLs), when those values were available in draft form. Since the finalization of the SSL Guidance, risk assessors are urged to consult the final SSL Guidance directly. The Guidance has detailed recommendations on site-specific sampling and site-specific SSL generation. (Soil Screening Guidance: User's Guide, April 1996, Publication 9355.4-23; and Soil Screening Guidance: Technical Background Document, May 1996; EPA/540/R-95/128)

- One user of the Table pointed out that the CAS numbers do not contain the dashes that are part of their format. CAS numbers have always appeared on the Table without dashes, but may be converted to their dashed form by placing a dash before the last number (farthest to the right), then moving two places to the left and placing another dash. For example, "107131" becomes "107-13-1"; "7440360" becomes "7440-36-0"; "25057890" becomes "25057-89-0." Region III could add the dashes directly to the Table, but we do not wish to make this change without feedback from users on whether this would adversely affect them. Therefore, we are soliciting comments on this issue (see box on first page for address).

FREQUENTLY ASKED QUESTIONS

To help you better understand the RBC Table, here are answers to our most often-asked questions:

1. How can the age-adjusted inhalation factor (11.66) be less than the inhalation rate for either a child (12) or an adult (20)?

   Age-adjusted factors are not intake rates, but rather partial calculations which have different units from intake rates. (Therefore, they are not directly comparable.) The fact that these partial calculations have values similar to intake rates is really coincidental, an

artifact of the similar magnitude of years of exposure and time-averaged body weight.

2. For manganese, IRIS shows an oral RfD of 0.14 mg/kg/day, but the RBC Table uses 2E-2 mg/kg/day. Why?

The IRIS RfD includes manganese from all sources, including diet. The explanatory text in IRIS recommends using a modifying factor of 3 when calculating risks associated with non-food sources, and the Table follows this recommendation. IRIS also recommends subtracting dietary exposure (default assumption in this case 5 mg). Thus, the IRIS RfD has been lowered by a factor of 2 x 3, or 6. The Table now reflects manganese RBCs for both "food" and "non-food" (most environmental) sources.

3. What is the source of the child's inhalation rate of 12 m^3/day?

The calculation comes from basic physiology. It's a scaling of the mass-specific 20 m^3/day rate for adults from a body mass of 70 kg to 15 kg, using the 2/3 power of mass, as follows:

Ircm = mass-specific child inhalation rate (m^3/kg/day)
Irc = child inhalation rate (m^3/day)

20 m^3/day / 70 kg = 0.286 m^3/kg/day (mass-specific adult inhalation rate)

0.286 m^3/kg/day x $(70^{0.67})$ = (Ircm) x $(15^{0.67})$

Ircm = 0.803 m^3/kg/day

Irc = Ircm x 15 kg = 0.803 m^3/kg/day x 15 kg = 12.04 m^3/day

4. Can the oral RfDs in the RBC Table be applied to dermal exposure?

Not directly. Oral RfDs are usually based on administered dose and therefore tacitly include a GI absorption factor. Thus, any use of oral RfDs in dermal risk calculations should involve removing this absorption factor. Consult the Risk Assessment Guidance for Superfund, Part A, Appendix A, for further details on how to do this.

5. The exposure variables table in the RBC background document lists the averaging time for non-carcinogens as "ED*365." What does that mean?

ED is exposure duration, in years, and * is the computer-ese symbol for multiplication. Multiplying ED by 365 simply converts the duration to days. In fact, the ED term is included in both the numerator and denominator of the RBC algorithms for non-cancer risk, canceling it altogether. See RAGS for more information.

6. Why is inorganic lead not included in the RBC Table?

EPA has no consensus RfD or CSF for inorganic lead, so it is not possible to calculate RBCs as we have done for other chemicals. EPA considers lead to be a special case because of the difficulty in identifying the classic "threshold" needed to develop an RfD.

EPA therefore evaluates lead exposure by using blood-lead modeling, such as the Integrated Exposure-Uptake Biokinetic Model (IEUBK). The EPA Office of Solid Waste has also released a detailed directive on risk assessment and cleanup of residential soil lead. The directive recommends that soil lead levels less than 400 mg/kg are generally safe for residential use. Above that level, the document suggests collecting data and modeling blood-lead levels with the IEUBK model. For the purposes of screening, therefore, 400 mg/kg is recommended for residential soils. For water, we suggest 15 ug/l (the EPA Action Level in water), and for air, the National Ambient Air Quality Standard.

7. Where did the CSFs for carcinogenic PAHs come from?

The PAH CSFs are all calculated relative to benzo[a]pyrene, which has an IRIS slope factor. The relative factors for the other PAHs can be found in "Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons," Final Draft, ECAO-CIN-842 (March, 1993).

8. May I please have a copy of a previous RBC Table?

We do not distribute outdated copies of the RBC Table. Each new version of the Table supersedes all previous versions.

9. Please elaborate on the meaning of the "W" source code in the Table.

The "W" code means that a RfD or CSF is currently not present on either IRIS or HEAST, but that it was once present on either IRIS or HEAST and was removed. Such withdrawal usually indicates that consensus on the number no longer exists among EPA scientists, but not that EPA believes the contaminant to be unimportant.

Withdrawn numbers are shown in the Table because we still need to deal with these contaminants during the long delays before replacement numbers are ready. For the purpose of screening, a "W" value is similar to a provisional value in that neither value has achieved Agency consensus. The "W" code should serve as a clear warning that before making any serious decision involving that contaminant, you will need to develop an interim value based on current scientific understanding.

If you are assessing risks at a site where a major contaminant is coded "W," consider working with your Region EPA risk assessor to develop a current toxicity constant. If the site is being studied under CERCLA, the EPA-NCEA Regional Technical Support group

may be able to assist.

10. Can I get copies of supporting documents for interim toxicity constants which are coded "E" in the RBC Table?

Unfortunately, Region 3 does not have a complete set of supporting documents. The EPA-NCEA Superfund Technical Support Center prepares these interim toxicity constants in response to site-specific requests from Regional risk assessors, and sends the documentation only to the requestor. The RBC Tables contain only the latest interim values that we've either requested or have otherwise received. NCEA maintains the master data base of these chemicals, but will not release documentation of provisional values unless they are recent. Furthermore, since NCEA's Superfund Technical Support Center is mainly for the support of Superfund, it usually cannot develop new criteria unless authorized to do so for a specific Superfund project.

If an "E"-coded contaminant is a chemical of potential concern at your site, we urge you to work with the EPA Regional risk assessor assigned to the project in order to develop or obtain documentation for provisional values. EPA Region 3 furnishes documents only when needed to support Regional risk assessments or recommendations.

Attached is a list of "E"-coded chemicals whose supporting documentation was issued prior to 1996, indicating that toxicity information may need to be updated.

11. Why is there no oral RfD for mercury? How should I handle mercury?

IRIS gives oral RfDs for mercuric chloride and for methylmercury, but not for elemental mercury. Therefore, the RBC Table reflects this primary source. Consult your toxicologist to determine which of the available mercury numbers is suitable for the conditions at your site (e.g., whether mercury is likely to be organic or inorganic.)

Attachments

Sources: I = IRIS H = HEAST A = HEAST Alternate W = Withdrawn from IRIS or HEAST
E = EPA-NCEA provisional value O = other

Basis: C = Carcinogenic effects N = Noncarcinogenic effects I = RBC at HI of 0.1 < RBC-c

Chemical	CAS	RfDo mg/kg/d		CSFo 1/mg/kg/d		RfDi mg/kg/d		CSFi 1/mg/kg/d		VOC	Risk-based concentrations: Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Residential mg/kg
ACETALDEHYDE	75070					2.57E-003	I	7.7E-003	I			8.1E-001 C			
ACETOCHLOR	34256821	2E-002	I								7.3E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N
ACETONE	67641	1.00E-001	I								3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N
ACETONITRILE	75058	6.00E-003	I			1.40E-002	A				2.2E+002 N	5.1E+001 N	8.1E+000 N	1.2E+004 N	4.7E+002 N
ACETOPHENONE	98862	1.00E-001	I			5.70E-006	W			y	4.2E-002 N	2.1E-002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N
ACROLEIN	107028	2.00E-002	H			5.70E-006	I			y	4.2E-002 N	2.1E-002 N	2.7E+001 N	4.1E+004 N	1.6E+003 N
ACRYLAMIDE	79061	2.00E-004	I	4.50E+000	I			4.50E+000	I		1.5E-002 C	1.4E-003 C	7.0E-004 C	1.3E+000 C	1.4E-001 C
ACRYLONITRILE	107131	1.00E-003	H	5.40E-001	I	5.70E-004	I	2.40E-001	I		1.2E-001 C	2.6E-002 C	5.8E-003 C	1.1E+001 C	1.2E+000 C
ALACHLOR	15972608	1.00E-002	I	8.00E-002	H						8.4E-001 C	7.8E-002 C	3.9E-002 C	7.2E+001 C	8.0E+000 C
ALAR	1596845	1.50E-001	I								5.5E+003 N	5.5E+002 N	2.0E+002 N	3.1E+005 N	1.2E+004 N
ALDICARB	116063	1.00E-003	I								3.7E+001 N	3.7E+000 N	1.4E+000 N	2.0E+003 N	7.8E+001 N
ALDICARB SULFONE	1646884	1.00E-003	I								3.7E+001 N	3.7E+000 N	1.4E+000 N	2.0E+003 N	7.8E+001 N
ALDRIN	309002	3.00E-005	I	1.70E+001	I			1.70E+001	I		3.9E-003 C	3.7E-004 C	1.9E-004 C	3.4E-001 C	3.8E-002 C
ALUMINUM	7429905	1.00E+000	E			1.00E-003	E				3.7E+004 N	3.7E+000 N	1.4E+003 N	2.0E+006 N	7.8E+004 N
AMINODINITROTOLUENES		6.00E-005	E								2.2E+000 N	2.2E-001 N	8.1E-002 N	1.2E+002 N	4.7E+000 N
4-AMINOPYRIDINE	504245	2.00E-005	H								7.3E-001 N	7.3E-002 N	2.7E-002 N	4.1E+001 N	1.6E+000 N
AMMONIA	7664417					2.86E-002	I			y	2.1E+002 N	1.0E+002 N			
ANILINE	62533			5.70E-003	I	2.90E-004	I			y	1.9E+000 C I	1.1E+000 N	5.5E-001 C	1.0E+003 C	1.1E+002 C
ANTIMONY	7440360	4.00E-004	I								1.5E+001 N	1.5E+000 N	5.4E-001 N	8.2E+002 N	3.1E+001 N
ANTIMONY PENTOXIDE	1314609	5.00E-004	H								1.8E+001 N	1.8E+000 N	6.8E-001 N	1.0E+003 N	3.9E+001 N
ANTIMONY TETROXIDE	1332816	4.00E-004	H								1.5E+001 N	1.5E+000 N	5.4E-001 N	8.2E+002 N	3.1E+001 N
ANTIMONY TRIOXIDE	1309644	4.00E-004	H			5.70E-005	I				1.5E+001 N	2.1E-001 N	5.4E-001 N	8.2E+002 N	3.1E+001 N
ARSENIC	7440382	3.00E-004	I	1.50E+000	I			1.51E+001	I		4.5E-002 C	4.1E-004 C	2.1E-003 C	3.8E+000 C	4.3E-001 C
ARSINE	7784421					1.40E-005	I			y	1.0E-001 N	5.1E-002 N			
ASSURE	76578148	9.00E-003	I								3.3E+002 N	3.3E+001 N	1.2E+001 N	1.8E+004 N	7.0E+002 N
ATRAZINE	1912249	3.50E-002	I	2.20E-001	H						3.0E-001 C	2.8E-002 C	1.4E-002 C	2.6E+001 C	2.9E+000 C
AZOBENZENE	103333			1.10E-001	I			1.10E-001	I		6.1E-001 C	5.7E-002 C	2.9E-002 C	5.2E+001 C	5.8E+000 C
BARIUM	7440393	7.00E-002	I			1.40E-004	A				2.6E+003 N	5.1E-001 N	9.5E+001 N	1.4E+005 N	5.5E+003 N
BAYGON	114261	4.00E-003	I								1.5E+002 N	1.5E+001 N	5.4E+000 N	8.2E+003 N	3.1E+002 N
BAYTHROID	68359375	2.50E-002	I								9.1E+002 N	9.1E+001 N	3.4E+001 N	5.1E+004 N	2.0E+003 N
BENTAZON	25057890	3.00E-002	I								1.1E+003 N	1.1E+002 N	4.1E+001 N	6.1E+004 N	2.3E+003 N
BENZALDEHYDE	100527	1.00E-001	I								3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N
BENZENE	71432	3.00E-003	E	2.90E-002	I	1.70E-003	E	2.90E-002	I	y	3.6E-001 C	2.2E-001 C	1.1E-001 C	2.0E+002 C	2.2E+001 C
BENZENETHIOL	108985	1.00E-005	H							y	6.1E-002 N	3.7E-002 N	1.4E-002 N	2.0E+001 N	7.8E-001 N
BENZIDINE	92875	3.00E-003	I	2.30E+002	I			2.30E+002	I		2.9E-004 C	2.7E-005 C	1.4E-005 C	2.5E-002 C	2.8E-003 C
BENZOIC ACID	65850	4.00E+000	I								1.5E+005 N	1.5E+004 N	5.4E+003 N	8.2E+006 N	3.1E+005 N
BENZYL ALCOHOL	100516	3.00E-001	H								1.1E+004 N	1.1E+003 N	4.1E+002 N	6.1E+005 N	2.3E+004 N
BENZYL CHLORIDE	100447			0.17	I					y	6.2E-002 C	3.7E-002 C	1.9E-002 C	3.4E+001 C	3.8E+000 C
BERYLLIUM	7440417	2.00E-003	I			5.7E-006	I	8.40E+000	I		7.3E+001 N	7.5E-004 C	2.7E+000 N	4.1E+003 N	1.6E+002 N
BIPHENYL	92524	5.00E-002	I							y	3.0E+002 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N
BIS(2-CHLOROETHYL)ETHER	111444			1.10E+000	I			1.10E+000	I		6.1E-002 C	5.7E-003 C	2.9E-003 C	5.2E+000 C	5.8E-001 C
BIS(2-CHLOROISOPROPYL)ETHER	108601	4.00E-002	I	7.00E-002	H			3.50E-002	H	y	2.6E-001 C	1.8E-001 C	4.5E-002 C	8.2E+001 C	9.1E+000 C
**BIS(CHLOROMETHYL)ETHER	542881			2.20E+002	I			2.20E+002	I	y	4.8E-005 C	2.8E-005 C	1.4E-005 C	2.6E-002 C	2.9E-003 C
**BIS(2-ETHYLHEXYL)PHTHALATE	117817	2.00E-002	I	1.40E-002	I			1.40E-002	E		4.8E+000 C	4.5E-001 C	2.3E-001 C	4.1E+002 C	4.6E+001 C
**BORON	7440428	9.00E-002	I			5.70E-003	H				3.3E+003 N	2.1E+001 N	1.2E+002 N	1.8E+005 N	7.0E+003 N

MRLs (ATSDR)

MRLs

Agency for Toxic Substances and Disease Registry

Division of Toxicology

ATSDR Contact Person for MRLs

Minimal Risk Levels (MRLs) for Hazardous Substances

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) [42 U.S.C. 9604 et seq.], as amended by the Superfund Amendments and Reauthorization Act (SARA) [Pub. L. 99-499], requires that the Agency for Toxic Substances and Disease Registry (ATSDR) develop jointly with the U.S. Environmental Protection Agency (EPA), in order of priority, a list of hazardous substances most commonly found at facilities on the CERCLA National Priorities List (NPL) (42 U.S.C. 9604(i)(2)); prepare toxicological profiles for each substance included on the priority list of hazardous substances, and to ascertain significant human exposure levels (SHELs) for hazardous substances in the environment, and the associated acute, subacute, and chronic health effects (42 U.S.C. 9604(i)(3)); and assure the initiation of a research program to fill identified data needs associated with the substances (42 U.S.C. 9604(i)(5)).

The ATSDR Minimal Risk Levels (MRLs) were developed as an initial response to the mandate. Following discussions with scientists within the Department of Health and Human Services (HHS) and the EPA, ATSDR chose to adopt a practice similar to that of the EPA's Reference Dose (RfD) and Reference Concentration (RfC) for deriving substance-specific health guidance levels for non-neoplastic endpoints. An MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse noncancer health effects over a specified duration of exposure. These substance-specific estimates, which are intended to serve as screening levels, are used by ATSDR health assessors and other responders to identify contaminants and potential health effects that may be of concern at hazardous waste sites. **It is important to note that MRLs are not intended to define clean-up or action levels for ATSDR or other Agencies.**

The toxicological profiles include an examination, summary, and interpretation of available toxicological information and epidemiologic evaluations of a hazardous substance. During the development of toxicological profiles, MRLs are derived when ATSDR determines that reliable and sufficient data exist to identify the target organ(s) of effect or the most sensitive health effect(s) for a specific duration for a given route of exposure to the substance. MRLs are based on noncancer health effects only and are not based on a consideration of cancer effects. Inhalation MRLs are exposure concentrations expressed in units of parts per million (ppm) for gases and volatiles, or milligrams per cubic meter (mg/m3) for particles. Oral MRLs are expressed as daily human doses in units of milligrams per kilogram per day (mg/kg/day).

ATSDR uses the no-observed-adverse-effect-level/uncertainty factor approach to derive MRLs for hazardous substances. They are set below levels that, based on current information, might cause adverse health effects in the people most sensitive to such substance-induced effects. MRLs are derived for acute (1-14 days), intermediate (15-364 days), and chronic (365 days and longer) exposure durations, and for the oral and inhalation routes of exposure. Currently, MRLs for the dermal route of exposure are not derived because ATSDR has not yet identified a method suitable for this route of exposure. MRLs are generally based on the most sensitive substance-induced end point considered to be of relevance to humans. ATSDR does not use serious health effects (such as irreparable damage to the liver or kidneys, or birth defects) as a basis for establishing MRLs. Exposure to a level above the MRL does not mean that adverse health effects will occur.

MRLs are intended to serve as a screening tool to help public health professionals decide where to look more closely. They may also be viewed as a mechanism to identify those hazardous waste sites that are not expected to cause adverse health effects. Most MRLs contain some degree of uncertainty because of the lack of precise toxicological information on the people who might be most sensitive (e.g., infants, elderly, and nutritionally or immunologically compromised) to the effects of hazardous substances. ATSDR uses a conservative (i.e., protective) approach to address these uncertainties consistent with the public health principle of prevention. Although human data are preferred, MRLs often must be based on animal studies because relevant human studies are lacking. In the absence of evidence to the contrary, ATSDR assumes that humans are more sensitive than animals to the effects of hazardous substances and that certain persons may be particularly sensitive. Thus, the resulting MRL may be as much as a hundredfold below levels shown to be nontoxic in laboratory animals.

Proposed MRLs undergo a rigorous review process. They are reviewed by the Health Effects/MRL Workgroup within the Division of Toxicology; an expert panel of external peer reviewers; the agency wide MRL Workgroup, with participation from other federal agencies, including EPA; and are submitted for public comment through the toxicological profile public comment period. Each MRL is subject to change as new information becomes available concomitant with updating the toxicological profile of the substance. MRLs in the most recent toxicological profiles supersede previously published levels. A listing of the current published MRLs is provided as follows.

ATSDR Contact Person

For additional information regarding MRLs, please contact:

Dr. Selene Chou
Division of Toxicology
Agency for Toxic Substances and Disease Registry
1600 Clifton Road, Mailstop E29
Atlanta, Georgia 30333
Telephone (404)639-6308 or 1-888-42-ATSDR (1-888-422-8737)
FAX (404)639-6315
E-Mail: cjc3@cdc.gov

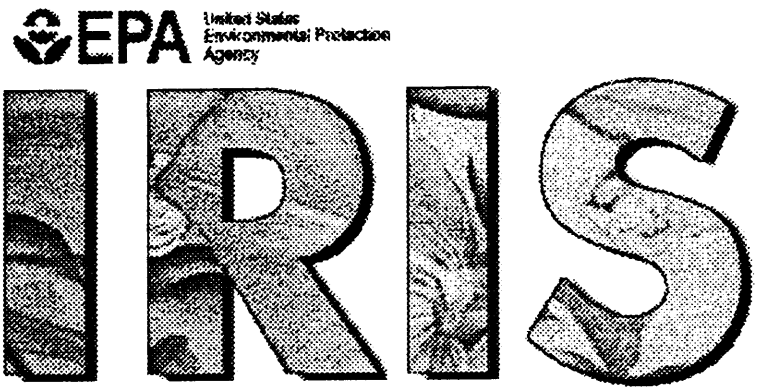
Note: Information is in landscape format. Please use scroll bar on the bottom of the screen to access all the information. You can also search the index of substances quickly by using the "Find" button.

ATSDR MINIMAL RISK LEVELS (MRLs)

April 1999

Name	Route	Dura-tion	MRL	Fac-tors	Endpoint	Draft/ Final	Cover Date	CAS Nu
ACENAPHTHENE	Oral	Int.	0.6 mg/kg/day	300	Hepatic	Final	08/95	000083
ACETONE	Inh.	Acute	26 ppm	9	Neurol.	Final	05/94	000067
		Int.	13 ppm	100	Neurol.			
		Chr.	13 ppm	100	Neurol.			
	Oral	Int.	2 mg/kg/day	100	Hemato.			
ACROLEIN	Inh.	Acute	0.00005 ppm	100	Ocular	Final	12/90	000107
		Int.	0.000009 ppm	1000	Resp.			
	Oral	Chr.	0.0005 mg/kg/day	100	Hemato.			
ACRYLONITRILE	Inh.	Acute	0.1 ppm	10	Neurol.	Final	12/90	000107
	Oral	Acute	0.1 mg/kg/day	100	Develop.			
		Int.	0.01 mg/kg/day	1000	Repro.			
		Chr.	0.04 mg/kg/day	100	Hemato.			
ALDRIN	Oral	Acute	0.002 mg/kg/day	1000	Develop.	Final	04/93	000309
		Chr.	0.00003 mg/kg/day	1000	Hepatic			
AMMONIA	Inh.	Acute	0.5 ppm	100	Resp.	Final	12/90	007664
		Chr.	0.3 ppm	10	Resp.			
	Oral	Int.	0.3 mg/kg/day	100	Other			
ANTHRACENE	Oral	Int.	10 mg/kg/day	100	Hepatic	Final	08/95	000120
AROCLOR 1254	Oral	Chr.	0.02 ug/kg/d	300	Immuno.	Draft	12/98	011097
ARSENIC	Oral	Chr.	0.0003 mg/kg/day	3	Dermal	Draft	10/98	007440
BENZENE	Inh.	Acute	0.05 ppm	300	Immuno.	Final	09/97	000071
		Int.	0.004 ppm	90	Neurol.			
BIS(CHLOROMETHYL) ETHER	Inh.	Int.	0.0003 ppm	100	Resp.	Final	12/89	000542

IRIS



What's New | Substance File List

Welcome to the IRIS home page, brought to you by the U.S. Environmental Protection Agency (EPA) and its Office of Research and Development, National Center for Environmental Assessment. IRIS is a database of human health effects that may result from exposure to various substances found in the environment. **Click on the Substance File List button to go to a list of the available substance files; then click on any file name on the list to open that file.** For more information about IRIS, read this **Introduction**.

Click here for What's New on IRIS, which highlights the most recent changes to IRIS files.

See the Glossary of Risk Assessment-Related Terms and the list of Acronyms and Abbreviations for more information explaining terms used in IRIS files.

A list of Toxicological Review support documents are available online. They are provided in the Adobe Acrobat Portable Document Format* (PDF).

Background Information on methods used by EPA for deriving values in IRIS is available here. Information on Limitations to the Use of IRIS is here. For information on downloading IRIS, see the Stand Alone (Downloadable) IRIS Database page.

Here are some links to other sources of environmental health information.

EPA is continuously seeking to improve the IRIS home page and the scientific content of IRIS. We welcome your comments and suggestions for improvements. Send comments to the IRIS webmaster by email to Iris.Webmaster@epa.gov

For technical questions about the scientific information content in IRIS, please call the U.S. EPA Risk Information Hotline at telephone 1-513-569-7254, or fax to 1-513-569-7159, or email to RIH.IRIS@epamail.epa.gov.

Navigation hints:
From the opening list of substances, you can click on individual substance names, or the list can be searched with your web browser, such as Netscape or Internet Explorer, by typing the name or Chemical Abstracts Service (CAS) Registry Number at the "**Find**"

HEAST

Environmental Protection Agency

Emergency Response

EPA-540-R-97-036
PB97-921199
July 1997

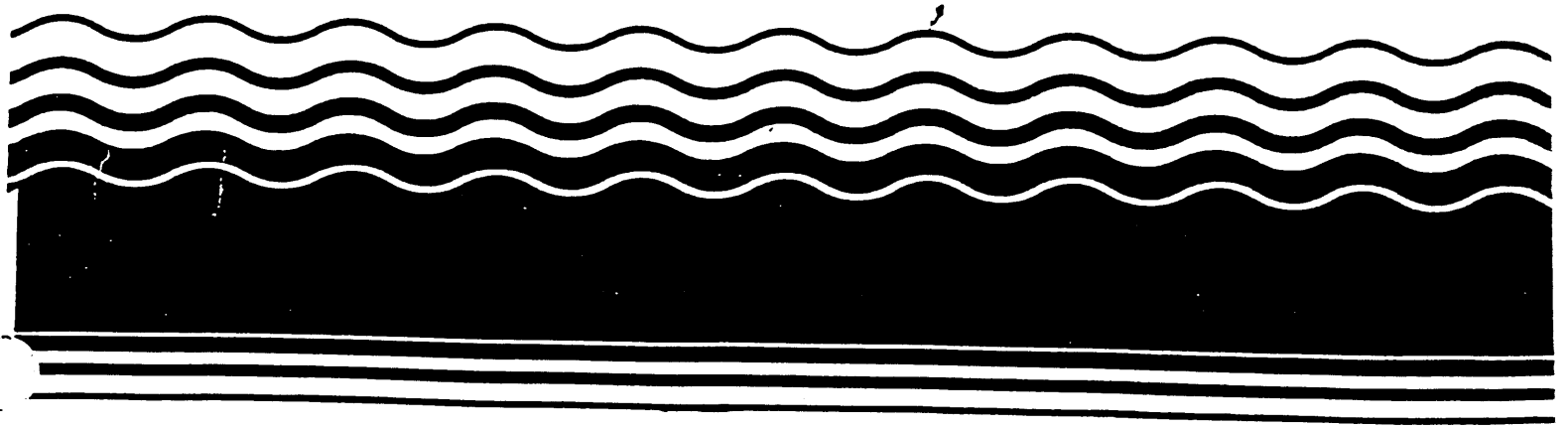
Superfund

EPA

Health Effects Assessment Summary Tables

PB97-921199

FY 1997 Update



APPENDIX E

Document for Generic Turner Method for Estimated Exposure from Near-Ground Releases to Air

ESTIMATING AMBIENT INHALATION EXPOSURES DUE TO NEAR-GROUND RELEASES OF PMN CHEMICALS

Turner's (1970) sector averaging form of the Gaussian algorithm can be used to estimate concentrations resulting from a point source release:

$$C = \left[\frac{(2.03)(Q)}{(X)(\delta z)(u)} \right] e^{-[(-0.5)(H/\delta z)^6]}$$

Where:

C	=	Concentration in ambient air (mg/m^3)
Q	=	Release rate (mg/sec)
H	=	Release height (m)
X	=	Receptor distance from source (m)
δz	=	Vertical dispersion coefficient (m)
u	=	Mean wind speed (m/sec)

Using the following assumptions, Equation No. 1 can be reduced to Equation No. 2:

$$Conc. = (Q)\ (6.165\ x\ 10^{-4})$$

H	=	3m
X	=	100m
δz	=	5m (assumes neutral atmospheric stability)
U^2	=	5.5 m/sec

$$Conc. = (Q)\ (6.165\ x\ 10^{-4})$$

Since Equation No. 1 and Equation No. 2 use units of mg/sec for Q and air releases may be reported in units of kg/yr, a conversion factor must be included in Equation No. 2. Assuming a continuous release, kg/yr can be converted to mg/sec by multiplying by 0.0317 (mg/sec)/(kg/yr). Thus, the revised Equation No. 2 is listed below as Equation No. 3.

It is unlikely that any long-term releases would be blown continuously in the same direction. It would be more reasonable to assume that, as a reasonable worst case, the wind blows in one direction 25 percent of the time. Thus, the corrected Equation No. 3 is listed below as Equation No. 4.

$$Conc. = (Q_{yr})(4.88 \times 10^{-6})$$

Annual exposure can be estimated using Equation No. 5.

$$EXPOSURE = (C)\ (IR)\ (D)\ (F)$$

Where:

C = Result from Equation No. 4
IR = Assumed to be 1 m^3/hr
D = 24 hrs/day
F = 365 days/yr

Using the above parameters in Equation No. 5, annual exposure can readily be estimated using Equation No. 6.

$$Annual\ Exposure = mg/yr = (Q_{yr}\ (0.043)$$

Note that because the exposure estimate is an annual average, it does not matter whether the release occurs on a long-term or short-term basis. The average annual exposure is the same for both situations assuming the annual amount released is the same.

APPENDIX F

Examples of Release, Site and Monitoring Data Collected by Committee

- Registered Source Emissions from MDE
- TAP Emission Data from MDE
- MDE Ambient Air Monitoring Station Description and Data
- Data Retrieved from TRI
- Data Retrieved from FINDS
- Dun and Bradstreet Facility Data
- MDE Facility Data

Registered Source Emissions Data from MDE

Registered Source Emissions - Zip Codes 21225 and 21226

No.	Premise Name and Address	Air Pollutant	Annual Emissions	Data Source
1	7-11 Station 400 Ritchie Highway	Volatile Organic Chemicals Toxic Air Pollutants	6,200 lbs NR	1995 Emissions Statement No Report
2	7-11 Station 5617 Ritchie Highway & Church Street	Volatile Organic Chemicals Toxic Air Pollutants	2,920 lbs NR	1995 Emissions Statement No Report
3	A-A Recycle & Sand 6931 Baltimore Annapolis Boulevard	Particulate Matter Sulfur Oxides Toxic Air Pollutants	1,560 lbs 320 lbs NR	1995 Emissions Statement 1995 Emissions Statement No Report
4	Amerada Hess Terminal 6299 Pennington Avenue	Particulate Matter Sulfur Oxides Nitrogen Oxides Carbon Monoxide Volatile Organic Chemicals Toxic Air Pollutants	4,460 lbs 51,980 lbs 18,320 lbs 1,660 lbs 172,280 lbs NR	1995 Emissions Statement 1995 Emissions Statement 1995 Emissions Statement 1995 Emissions Statement 1995 Emissions Statement No Report
5	Amoco Station 101 West Patapsco Avenue	Volatile Organic Chemicals Toxic Air Pollutants	23,000 lbs NR	1995 Emissions Statement No Report
6	Amoco Station 5500 Ritchie Highway	Volatile Organic Chemicals Toxic Air Pollutants	22,560 lbs NR	1995 Emissions Statement No Report
7	Amoco Asphalt Terminal 3901 Asiatic Avenue	Particulate Matter Sulfur Oxides Nitrogen Oxides Carbon Monoxide Volatile Organic Chemicals Toxic Air Pollutants	360 lbs 10,940 lbs 5,100 lbs 1,460 lbs 2,420 lbs NR	1995 Emissions Statement 1995 Emissions Statement 1995 Emissions Statement 1995 Emissions Statement 1995 Emissions Statement No Report
8	Amoco Terminal 6101 Pennington Avenue	Particulate Matter Sulfur Oxides Nitrogen Oxides Carbon Monoxide Volatile Organic Chemicals Toxic Air Pollutants	2,400 lbs 27,600 lbs 9,600 lbs 1,200 lbs 1,000 lbs NR	1995 Emissions Statement 1995 Emissions Statement 1995 Emissions Statement 1995 Emissions Statement 1995 Emissions Statement No Report
9	Amoco Terminal 801 East Ordnance Road	Volatile Organic Chemicals Toxic Air Pollutants	85,040 lbs NR	1995 Emissions Statement No Report
10	Ansam Metals Corp. 1026 East Patapsco Avenue	Particulate Matter Sulfur Oxides Nitrogen Oxides Carbon Monoxide Volatile Organic Chemicals Toxic Air Pollutants	560 lbs 580 lbs 400 lbs 2,880 lbs 780 lbs NR	1995 Emissions Statement 1995 Emissions Statement 1995 Emissions Statement 1995 Emissions Statement 1995 Emissions Statement No Report
11	Arundel Corp 4th & Frankfurst Avenue	Particulate Matter Sulfur Oxides Nitrogen Oxides Carbon Monoxide Toxic Air Pollutants	40,120 lbs 1,500 lbs 740 lbs 240 lbs NR	1995 Emissions Statement 1995 Emissions Statement 1995 Emissions Statement 1995 Emissions Statement No Report
12	Arundel Elementary School 2400 Round Way	Particulate Matter Sulfur Oxides Nitrogen Oxides Carbon Monoxide Toxic Air Pollutants	360 lbs 1,080 lbs 1,080 lbs 360 lbs NR	1995 Emissions Statement 1995 Emissions Statement 1995 Emissions Statement 1995 Emissions Statement No Report
13	Atotech USA 1900 Chesapeake Avenue	Particulate Matter Nitrogen Oxides Carbon Monoxide Antimony Compounds Chromium Compounds Nitric Acid Zinc Compounds	3,980 lbs 17,780 lbs 240 lbs 2,673 lbs 1 lb 1 lb 1 lb	1995 Emissions Statement 1995 Emissions Statement 1995 Emissions Statement 1994 EPA Form R 1994 EPA Form R 1994 EPA Form R 1994 EPA Form R
14	Autobahn Motors 3704 South Hanover Street	Volatile Organic Chemicals Toxic Air Pollutants	2,520 lbs NR	1995 Emissions Statement No Report
15	Automated Plating 1927 Benhill Avenue	Nitrogen Oxides Toxic Air Pollutants	360 lbs NR	1995 Emissions Statement No Report
16	Baltimore City Composting Facility 5800 Quarantine Road	Volatile Organic Chemicals Toxic Air Pollutants	360 lbs NR	1995 Emissions Statement No Report
17	Baltimore Scrap 1600 Carbon Avenue	Particulate Matter Toxic Air Pollutants	1,820 lbs NR	1995 Emissions Statement No Report

TAP Emissions Data from MDE

TAP Emissions in Zip Codes 21225 & 21226

Premise Number	Plant name	Street Address	Zip Code	Pollutant	CAS #	Emissions lbs/hr	Emissions tons/year
02-0023	VALLEY PROTEINS	1515 OPEN STREET CURTIS BAY	21226	Chlorine dioxide (AAL-15,5) Stack	10049044	0 0833	0 2520
02-0044	REICHHOLD CHEMICAL	6401 CHEMICAL ROAD BALTIMORE	21226	Ethyl benzene	100414	0 2500	0 0174
02-0044	REICHHOLD CHEMICAL	6401 CHEMICAL ROAD BALTIMORE	21226	Ethylene glycol	107211	0 0070	0 0056
02-0044	REICHHOLD CHEMICAL	6401 CHEMICAL ROAD BALTIMORE	21226	Methyl isobutyl ketone	108101	1 0200	0 1055
02-0044	REICHHOLD CHEMICAL	6401 CHEMICAL ROAD BALTIMORE	21226	Maleic anhydride	108316	0 0020	0 0006
02-0044	REICHHOLD CHEMICAL	6401 CHEMICAL ROAD BALTIMORE	21226	Toluene	108883	0 6700	0 0804
02-0044	REICHHOLD CHEMICAL	6401 CHEMICAL ROAD BALTIMORE	21226	2-Butoxyethanol	111762	0 0590	0 0126
02-0044	REICHHOLD CHEMICAL	6401 CHEMICAL ROAD BALTIMORE	21226	Ethanol,2-(2-butoxyethoxy) (X)	112345	0 3900	0 0448
02-0044	REICHHOLD CHEMICAL	6401 CHEMICAL ROAD BALTIMORE	21226	Xylene	1330207	1 8000	0 2665
02-0044	REICHHOLD CHEMICAL	6401 CHEMICAL ROAD BALTIMORE	21226	Isophorone diisocyanate	4098719	0 0000	0 0000
02-0044	REICHHOLD CHEMICAL	6401 CHEMICAL ROAD BALTIMORE	21226	Toluene 2,4-diisocyanate	584849	0 0020	0 0004
02-0044	REICHHOLD CHEMICAL	6401 CHEMICAL ROAD BALTIMORE	21226	Isopropyl alcohol	67630	0 7500	0 0500
02-0044	REICHHOLD CHEMICAL	6401 CHEMICAL ROAD BALTIMORE	21226	n-Butyl alcohol	71363	0 2700	0 0625
02-0044	REICHHOLD CHEMICAL	6401 CHEMICAL ROAD BALTIMORE	21226	sec-Butyl alcohol	78922	0 2200	0 0156
02-0044	REICHHOLD CHEMICAL	6401 CHEMICAL ROAD BALTIMORE	21226	Methyl ethyl ketone	78933	0 0160	0 0355
02-0044	REICHHOLD CHEMICAL	6401 CHEMICAL ROAD BALTIMORE	21226	Toluene, 2,6-diisocyanate	91087	0 0011	0 0002
02-0055	SOUTHERN STATES CORP.	ORDINANCE ROAD & PENNINGTON	21226	Manganese & compounds (Fumes)	7439965	0 0007	0 0002
02-0055	SOUTHERN STATES CORP.	ORDINANCE ROAD & PENNINGTON	21226	Copper & compounds	7440508	0 0007	0 0002
02-0055	SOUTHERN STATES CORP.	ORDINANCE ROAD & PENNINGTON	21226	Phosphoric acid	7664382	0 0000	0 0000
02-0056	CHEMETALS CORPORATION	711 PITTMAN ROAD, CURTIS BAY	21226	Manganese & compounds (Fumes)	7439965	5 0057	21 9250
02-0056	CHEMETALS CORPORATION	711 PITTMAN ROAD, CURTIS BAY	21226	Hydrogen chloride (AAL-117)	7647010	1 5600	6 8330
02-0056	CHEMETALS CORPORATION	711 PITTMAN ROAD, CURTIS BAY	21226	Ammonia (AAL-450,300) Eliminated change of Paper	7664417	6 8000	29 7840
02-0056	CHEMETALS CORPORATION	711 PITTMAN ROAD, CURTIS BAY	21226	Sulfuric acid Stack	7664939	0 4130	1 8105
02-0056	CHEMETALS CORPORATION	711 PITTMAN ROAD, CURTIS BAY	21226	Hydrogen peroxide	7722841	0 3000	1 3140
02-0056	CHEMETALS CORPORATION	711 PITTMAN ROAD, CURTIS BAY	21226	Hydrogen sulfide Stack	7783064	0 0016	0 0070
02-0309	AMOCO OIL COMPANY	16 ORDINANCE ROAD CURTIS BAY	21226	Ethyl benzene	100414	0 0790	0 3470
02-0309	AMOCO OIL COMPANY	16 ORDINANCE ROAD CURTIS BAY	21226	Toluene Fugitive	108883	1 1100	4 8730
02-0309	AMOCO OIL COMPANY	16 ORDINANCE ROAD CURTIS BAY	21226	Phenol	108952	0 0000	0 0000
02-0309	AMOCO OIL COMPANY	16 ORDINANCE ROAD CURTIS BAY	21226	Xylene	1330207	0 3000	1 3000
02-0309	AMOCO OIL COMPANY	16 ORDINANCE ROAD CURTIS BAY	21226	Methyl-tertiary-butyl-ether(X)	1634044	2 3400	10 2000
02-0309	AMOCO OIL COMPANY	16 ORDINANCE ROAD CURTIS BAY	21226	Benzene	71432	0 4620	2 0200
02-0316	US COAST GUARD	CONCRETE ROAD	21226	Methylene bis(phenylisocyanate)	101688	0 0000	0 0000
02-0316	US COAST GUARD	CONCRETE ROAD	21226	Ethylene glycol	107211	0 1600	0 1700
02-0316	US COAST GUARD	CONCRETE ROAD	21226	Methyl isobutyl ketone	108101	0 4000	0 2835
02-0316	US COAST GUARD	CONCRETE ROAD	21226	Toluene	108883	0 4000	0 3870
02-0316	US COAST GUARD	CONCRETE ROAD	21226	2-Butoxyethanol Fugitive	111762	0 0560	0 0585
02-0316	US COAST GUARD	CONCRETE ROAD	21226	Perchloroethylene	127184	0 0200	0 0185
02-0316	US COAST GUARD	CONCRETE ROAD	21226	Sodium hydroxide	1310732	0 0020	0 0025
02-0316	US COAST GUARD	CONCRETE ROAD	21226	Manganese Oxide	1313139	0 0020	0 0120
02-0316	US COAST GUARD	CONCRETE ROAD	21226	Xylene	1330207	0 0600	0 0575
02-0316	US COAST GUARD	CONCRETE ROAD	21226	Carbonic Acid Disodium Salt	497198	0 0012	0 0050

MDE Ambient Air Monitoring Station Description and Data

6/24/97

MARYLAND DEPARTMENT OF THE ENVIRONMENT
AIR AND RADIATION MANAGEMENT ADMINISTRATION
TOXICS MONITORING IN MARYLAND

EPA Method TO-14 Toxics Monitoring Network

We are collecting 24 hour canister samples every sixth day on the EPA schedule at these sites:

1. Essex
2. North East Police Station (NEPS)
3. Old Town Fire Department
4. Ft. McHenry
5. FMC
6. Glenn Burnie

also (samples collected by the local or State agency, analyzed by ARMA)

7. Flag Plaza, Pittsburgh
8. AMSL, Philadelphia
9. Lums Pond, DE.
10. Washington, DC.
11. Chester, PA.
12. Marcus Hook, PA.
13. Chester, WVA.
14. Three sites in Ohio (on a variable schedule).

We have been designated as the Quality Assurance laboratory for EPA Region III and split QA samples with Virginia and EPA Regions I and II.

Samples are collected using either an EPA designed and fabricated sampler or the XonTech Model 810A Ambient Air Collection Sampler. Samples are collected into evacuated (less than 1 mm Hg absolute pressure) 6 liter SUMMA treated stainless steel sampling canisters and filled to a pressure of about 2 atmospheres over the day (midnight to midnight). At midnight of the sampling day the sampler starts a pump which pulls ambient air through a stainless steel sampling cane and pushes the air through a mass flow controller, a shut off valve and into the canister. The flow rate of 8.3 millimeters per minute is maintained throughout the 24 hours.

At the end of the 24 hour period the shut off valve is closed to trap the sample in the canister and the sampler turns off. Between the sampling dates ARMA personnel visit the site, close the manual valve on the canister, remove the canister from the sampler and place a new canister on the sampler for the next sampling date.

The canisters are returned to the laboratory for analysis using an EnTech Model 2000 Preconcentrator and a Hewlett-Packard Model 5890 gas chromatograph with a Model 5971 mass selective detector (GC/MSD). We are following EPA COMPENDIUM METHOD TO-14, "The Determination of Volatile Organic Compounds (VOCs) in Ambient Air Using SUMMA Passivated Canister Sampling and Gas Chromatographic Analysis".

FORTY ONE COMPOUNDS DETERMINED BY GC/MSD USING EPA METHOD TO-14

Benzene
Bromomethane
1,3-Butadiene
Carbon Tetrachloride
Chlorobenzene
Chloroethane
Chloroethene
Chloroform
Chloromethane
Chloromethylbenzene
1,2-Dibromoethane
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
Dichlorodifluoromethane
1,1-Dichloroethane
1,2-Dichloroethane
1,1-Dichloroethene
cis-1,2-Dichloroethene
1,2-Dichloropropane
cis-1,3-Dichloropropene
trans-1,3-Dichloropropene
1,2-Dichloro-1,1,2,2-tetrafluoroethane
Ethylbenzene
1-Ethyl-4-methyl benzene
Hexachloro-1,3-butadiene
Methylene chloride
Styrene
1,1,2,2-Tetrachloroethane
Tetrachloroethene
Toluene
1,2,4-Trichlorobenzene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethene
Trichlorofluoromethane
1,1,2-Trichloro-1,2,2-trifluoroethane
1,2,4-Trimethylbenzene
1,3,5-Trimethylbenzene
o-Xylene
m & p-Xylene

GENERAL AIR QUALITY

The U.S. Environmental Protection Agency (EPA) has established National Ambient Air Quality Standards (NAAQS) for six criteria pollutants: (1) sulfur dioxide, (2) particulate matter, (3) carbon monoxide, (4) nitrogen dioxide, (5) ozone, and (6) lead. The primary standards were established to protect public health, and the secondary standards were developed to protect against non-health effects such as damage to property and vegetation.

The Department operates an air monitoring network throughout the State in accordance with EPA guidelines to measure the concentrations of the criteria pollutants in the ambient air. These measurements have been used to project statewide ambient air quality and have indicated that south Baltimore meets the ambient air quality standards for sulfur dioxide, particulate matter, carbon monoxide, nitrogen dioxide, and lead.

Ground level ozone continues to present a problem for the Baltimore/Washington area, which is classified as a non-attainment area for ozone. The primary contributors to the formation of ozone are emissions of oxides of nitrogen, primarily from combustion equipment, and emissions of Volatile Organic Compounds (VOC) such as paint solvents and gasoline vapors.

A brief description of this complicated method is as follows:

The sample canisters, along with a canister of zero air, a QA mixture and a canister of standard gas, are placed on a sixteen position sampling manifold. Pollutants in the air (zero air, standard, QA mix or sample) are concentrated using an EnTech Model 2000 Preconcentrator. A glass bead trap is cooled to -150 C and then 500 ml of sample is pulled through the trap. The organic compounds in the air freeze out on the glass beads while the normal air constituents (including methane) pass through the trap. A second smaller trap is then cooled to -160 C. The first trap is heated to 180 C and the collected compounds are driven off of the trap onto the second focusing trap using a smaller volume of gas (7 ml). After the compounds are transferred to the focusing trap, this trap is heated to 75 C and the compounds are driven off of the trap into the GC.

The compounds pass through the GC and are separated so that the most volatile pass through first. The compounds then pass from the GC to the MSD where they are detected. Two analysis of zero air are made first to show that the analytical system is clean. Then the system is calibrated using three levels of a 41 compound known standard mixture. These compounds are specified in the TO-14 Method and are listed on the attached table. Then a QA mixture containing four compounds of known amounts prepared by a different method are analyzed to double check the system. After the system is shown to be clean, is calibrated and passes the QA check, the samples are analyzed in the sample manner as the standards. Results are obtained by comparing the signal amounts from the samples to the known signals from the standard mixture. This is done using the HP software that is used with the GC/MSD and reports are obtained for each sample with the 41 compounds listed in parts per billion.

TWENTY FOUR HOUR TOXICS AIR SAMPLING
PARTS PER BILLION V/V, 1992

COMPOUNDS	OLD TOWN			F.M.C. CORP.			FORT McHENRY		
	MIN.	MAX.	AVG.	MIN.	MAX.	AVG.	MIN.	MAX.	AVG.
Dichlorodifluoromethane	0.00	1.47	0.71	0.29	1.30	0.64	0.19	1.28	0.68
Chloromethane (Methyl chloride)	0.14	1.35	0.59	0.26	2.11	0.78	0.16	1.23	0.62
1,2-dichloro-1,1,2,2-tetrafluoroethane	0.00	0.03	0.01	0.00	0.03	0.01	0.00	0.03	0.02
Chloroethene (Vinyl chloride)	0.00	0.17	0.01	0.00	0.15	0.01	0.00	0.17	0.01
1,3-Butadiene	0.00	0.51	0.26	0.00	0.37	0.10	0.00	0.21	0.09
Bromomethane (Methyl bromide)	0.00	0.14	0.02	0.00	0.63	0.05	0.00	0.14	0.03
Chloroethane (Ethyl chloride)	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00
Trichlorofluoromethane	3.33	39.34	9.95	0.22	4.28	0.55	0.29	1.06	0.45
1,1-Dichloroethene	0.00	0.13	0.02	0.00	0.09	0.02	0.00	0.14	0.03
Methylene chloride (Dichloromethane)	0.12	6.75	0.50	0.08	5.59	0.40	0.09	3.16	0.30
1,1,2-trichloro-1,2,2-trifluoroethane	0.43	3.89	1.16	0.16	2.59	0.39	0.07	0.26	0.13
1,1-Dichloroethane	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
cis 1,2-Dichloroethene	0.00	0.05	0.00	0.00	0.01	0.00	0.00	0.04	0.00
Chloroform (Trichloromethane)	0.00	0.16	0.06	0.00	0.16	0.04	0.00	0.11	0.05
1,2-Dichloroethane (EDC)	0.00	0.07	0.01	0.00	0.09	0.01	0.00	0.07	0.01
1,1,1-trichloroethane	0.15	2.66	0.51	0.17	0.74	0.37	0.22	1.05	0.39
Benzene	0.54	2.71	1.09	0.20	6.03	1.32	0.20	1.29	0.53
Carbon tetrachloride	0.04	0.24	0.12	0.05	1.71	0.20	0.03	0.20	0.12
1,2-Dichloropropane	0.00	0.02	0.00	0.00	0.11	0.00	0.00	0.01	0.00
Trichloroethene (Trichloroethylene)	0.00	0.29	0.03	0.00	0.17	0.02	0.00	0.13	0.03
cis-1,3-dichloropropene	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
trans-1,3-dichloropropene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00
1,1,2-Trichloroethane	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.00	0.00
Toluene	0.83	6.91	2.35	0.30	9.74	2.00	0.28	2.89	1.10
1,2-Dibromoethane (Ethylene dibromide)	0.00	0.07	0.00	0.00	0.07	0.01	0.00	0.07	0.01
Tetrachloroethene (Perchloroethylene)	0.05	0.56	0.16	0.00	0.20	0.10	0.00	0.21	0.09
Chlorobenzene	0.00	0.03	0.00	0.00	0.11	0.04	0.00	0.08	0.01
Ethylbenzene	0.14	1.09	0.38	0.05	1.00	0.27	0.06	0.50	0.18
meta & para-Xylene	0.49	3.24	1.26	0.16	4.05	0.97	0.17	1.46	0.60
Styrene	0.02	0.32	0.10	0.00	0.22	0.07	0.00	0.45	0.05
1,1,2,2-Tetrachloroethane	0.00	0.02	0.00	0.00	0.03	0.00	0.00	0.02	0.00
ortho-Xylene	0.18	1.18	0.52	0.08	1.14	0.35	0.09	1.81	0.36
1-Ethyl-4-methyl benzene	0.00	0.64	0.24	0.02	0.44	0.09	0.02	0.15	0.05
1,3,5-Trimethylbenzene	0.08	0.78	0.30	0.00	0.23	0.09	0.02	0.14	0.06
1,2,4-Trimethylbenzene (Pseudocumene)	0.22	2.68	0.93	0.05	0.76	0.26	0.06	0.44	0.17
1,3-Dichlorobenzene	0.00	0.15	0.01	0.00	0.03	0.01	0.00	0.05	0.01
Chloromethylbenzene	0.00	0.00	0.00	0.00	1.33	0.03	0.00	0.00	0.00
1,4-Dichlorobenzene(p-Dichlorobenzene)	0.00	0.17	0.05	0.00	0.09	0.03	0.00	0.12	0.03
1,2-Dichlorobenzene(o-Dichlorobenzene)	0.00	0.04	0.00	0.00	0.05	0.01	0.00	0.03	0.00
1,2,4-Trichlorobenzene	0.00	0.02	0.00	0.00	0.10	0.01	0.00	0.01	0.00
Hexachloro-1,3-butadiene	0.00	0.01	0.00	0.00	0.05	0.00	0.00	0.00	0.00

Data Retrieved from TRI

OBS	Facility Name	Address	TRI Facility ID	State County FIPS	ZIP	Preferre Latitude	Preferred Longitud	Standard Industry Code	Chemical Name	Y if Carcinoge	Total Air Emission	Fugitive Air Emission	Stack Air Emission	Reportin Year
302	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	METHANOL	N	1500	750	750	1987
303	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	DICHLOROMETHANE	Y	7000	4000	3000	1987
304	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	METHYL ISOBUTYL KETONE	N	500	250	250	1987
305	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	HYDROCHLORIC ACID	N	500	250	250	1987
306	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	METHANOL	N	808	740	68	1988
307	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	ACETONITRILE	Y	9	6	3	1988
308	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	DICHLOROMETHANE	Y	5200	2700	2500	1988
309	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	METHYL ISOBUTYL KETONE	N	21	4	17	1988
310	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	HYDROCHLORIC ACID	N	3	1	2	1988
311	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	METHANOL	N	500	250	250	1989
312	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	ACETONITRILE	Y	500	250	250	1989
313	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	DICHLOROMETHANE	Y	2900	1500	1400	1989
314	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	METHYL ISOBUTYL KETONE	N	500	250	250	1989
315	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	HYDROCHLORIC ACID	N	500	250	250	1989
316	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	AMMONIA	N	500	250	250	1989
317	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	SULFURIC ACID	N	0	0	0	1989
318	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	METHANOL	N	500	250	250	1990
319	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	ACETONITRILE	Y	500	250	250	1990
320	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	DICHLOROMETHANE	Y	2900	1500	1400	1990
321	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	METHYL ISOBUTYL KETONE	N	500	250	250	1990
322	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	HYDROCHLORIC ACID	N	500	250	250	1990
323	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	AMMONIA	N	500	250	250	1990
324	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	SULFURIC ACID	N	10	5	5	1990
325	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	METHANOL	N	35	20	15	1991
326	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	ACETONITRILE	Y	210	10	200	1991
327	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	DICHLOROMETHANE	Y	2900	1500	1400	1991
328	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	METHYL ISOBUTYL KETONE	N	450	200	250	1991
329	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	TOLUENE	N	60	10	50	1991
330	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	HYDROCHLORIC ACID	N	600	300	300	1991
331	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	AMMONIA	N	125	100	25	1991
332	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	SULFURIC ACID	N	0	0	0	1991
333	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	METHANOL	N	300	200	100	1992
334	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	ACETONITRILE	Y	42	2	40	1992
335	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	DICHLOROMETHANE	Y	1769	915	854	1992
336	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	HYDROCHLORIC ACID	N	360	180	180	1992
337	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	DICHLOROMETHANE	Y	1815	250	1565	1994
338	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	TOLUENE	N	255	5	250	1994
339	CONSOLIDATED PH	6110 ROBINWOOD	21225KNSCL6118R	24003	####	39.208	76.6269	2834	HYDROCHLORIC ACID	N	250	0	250	1994
64	ATOTECH USA INC.	1900 CHESAPEAK	21226MTCHM1900C	24510	####	39.239	76.5724	2819	ANTIMONY	N	7079	250	6829	1987
65	ATOTECH USA INC.	1900 CHESAPEAK	21226MTCHM1900C	24510	####	39.239	76.5724	2819	BARIUM	N	500	250	250	1987
66	ATOTECH USA INC.	1900 CHESAPEAK	21226MTCHM1900C	24510	####	39.239	76.5724	2819	CHROMIUM	Y	500	250	250	1987
67	ATOTECH USA INC.	1900 CHESAPEAK	21226MTCHM1900C	24510	####	39.239	76.5724	2819	ZINC (FUME OR DUST)	N	500	250	250	1987
68	ATOTECH USA INC.	1900 CHESAPEAK	21226MTCHM1900C	24510	####	39.239	76.5724	2819	NITRIC ACID	N	500	250	250	1987
69	ATOTECH USA INC.	1900 CHESAPEAK	21226MTCHM1900C	24510	####	39.239	76.5724	2819	NITRIC ACID	N	500	250	250	1988
70	ATOTECH USA INC.	1900 CHESAPEAK	21226MTCHM1900C	24510	####	39.239	76.5724	2819	ANTIMONY COMPOUNDS	N	4434	250	4184	1988

Data Retrieved from FINDS

FINDS zip code 21225

5 PGS

TABLE 3 FACILITY DATA IN ZIP CODE 21225

	A	B	C	D	E	F	G	H	I	J	K
1	FACILITY	FACILITY NAME	FACILITY ADDRESS	CITY	STATE	ZIP	REGION	COUNTY CODE	COUNTY NAME	NO OF PO	NO OF PO
2	ID					CODE				SYSTEMS	RECORDS
3	MDD000825745	BROOKLYN PARK ELEMENTARY	200 14TH ST	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	1	1
4	MDD985378876	ACME ANTI SKID CORP	3437 S HANOVER ST	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	1	1
5	MDD063208979	ALBAN ENGINE POWER INC	1401 CHERRY HILL RD	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	1	1
6	MDD094884095	AMERICAN DISH SVCE OF BALTIMOR	4701 BELLE GROVE RD BLDG G	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	1	1
7	MDD069372746	AMERICAN TANK TRANSPORT INC	6350 ORDNANCE POINT RD	CURTIS BAY	MD	21225	3	3	ANNE ARUNDEL	1	1
8	MDD985386945	AMOCO #715-TANKS	101 W PATAPSCO AVE	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	1	1
9	MDD985387620	AMOCO #84813-TANKS	5502 RITCHIE HWY	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	1	1
10	MDD985407337	ANSAM METALS CORP	1026 E PATAPSCO AVE	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	1	1
11	MDD985382043	B & G BODY WORKS INC	3 SEWARD AVE	BALTIMORE	MD	212252229	3	3	ANNE ARUNDEL	2	3
12	MDD985398577	B&J TRUCK & EQUIP REPAIR SER	601 W PATAPSCO AVE	BROOKLYN PARK	MD	21225	3	3	ANNE ARUNDEL	1	1
13	MDD981106131	BALTIMORE HARBOR TUNNEL	FRANKFURST AVE NEAR CHILDS ST	BALTIMORE	MD	212251636	3	3	ANNE ARUNDEL	1	1
14	MDD981937378	BROOKLYN MEDICAL CTR	3721 POTEE ST STE 1	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	1	1
15	MDD022411045	BROOKLYN MOTORS INC	2900 S HANOVER ST	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	1	1
16	MDD985369362	BROOKLYN PARK JR HIGH	200 HAMMONS LANE	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	2	3
17	MDD985398940	BROOKLYN SVC CTR	900 E PATAPSCO AVE	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	1	1
18	MDD985372218	BROWNS BODY & FENDER	516 PONTIAC AVE	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	2	3
19	MDD022432736	BROWNS HONDA CITY HONDA	5810 RITCHIE HWY	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	2	3
20	MDD985380864	CAPITOL AWARDS & PRO	3835 S HANOVER ST	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	1	1
21	MDD990810061	CHEMICAL SPECIALTIES MFG CORP	PATAPSCO AVE	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	1	1
22	MDD980712608	CHESAPEAKE & POTOMAC TELE CO	1401 N RITCHIE HWY	GLEN BURNIE	MD	21225	3	3	ANNE ARUNDEL	2	2
23	MDD980713838	CHESAPEAKE & POTOMAC TELE CO	206-212 FRANKLE ST	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	1	1
24	MDD980918205	CLEAN AMERICA INC	3300 CHILD ST	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	1	1
25	MDD000604090	COASTAL TANK LINES INC	527 CHESAPEAKE AVE	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	2	3
26	MDD985413061	CONCRETE TRANSPORT INC	200 FRANKFURST AVE	BALTIMORE	MD	212251600	3	3	ANNE ARUNDEL	1	2
27	MDD985380484	COPANOS CO JOHN D	6110 ROBINWOOD PARK	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	2	2
28	MDD985402932	CRANE KIRBY INC	600 W PATAPSCO AVE	BALTIMORE	MD	212251605	3	3	ANNE ARUNDEL	1	1
29	MDD985370634	CROWN STA	5701 RITCHIE HWY	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	1	1
30	MDD985370477	CROWN STA	3550 POTEE ST	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	2	3
31	MDD003062197	DENTOCIDE CHEM CO	3437 S HANOVER ST	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	2	3
32	MDD002487585	DREVER CO HEAT TREATING DIV	6201 ROBINWOOD RD	BROOKLYN PARK	MD	21225	3	3	ANNE ARUNDEL	1	4
33	MDD985388875	EXECUTIVE RADIATOR SERVICE INC	6038 BELLE GROVE RD	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	2	3
34	MDD981106073	FORT MCHENRY TUNNEL	KEITH & LELAND AVENUES	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	1	1
35	MDD985381136	GISCHEL MACHINE CO	5511 MAGIE ST	BROOKLYN	MD	21225	3	3	ANNE ARUNDEL	1	1
36	MDD045674751	HARBISON WALKER REFRACTORIES B	1200 PATAPSCO AVE	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	1	1
37	MDD007996044	JOSEPH J HOCK INC	5500 BELLE GROVE RD	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	3	4
38	MDD985392034	HOUSING AUTHORITY OF BALTIMORE CITY	4140 10TH STREET	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	3	4
39	MDD982567240	IA CONST CORP - BROOKLYN	200 FRANKFURST AVE	BROOKLYN	MD	21225	3	3	ANNE ARUNDEL	1	1
40	MDD003085974	JARVIS STEEL & LUMBER CO INC	3437 NINTH STREET	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	1	1
41	MDD981102791	K & T AUTO BODY	1 HAMMONDS LN	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	2	3
42	MDD082616020	K & T BODY SHOP	5826 RITCHIE HWY	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	1	1
43	MDD038942884	KANASCO LTD	6118 ROBINWOOD RD	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	1	1
44	MDD985412857	KANASCO LTD	6110 ROBINWOOD RD	BALTIMORE	MD	212253835	3	3	ANNE ARUNDEL	2	2
45	MDD003062833	KNIPP & CO	3401 S HANOVER ST	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	1	1
46	MDD010089365	JS LEES BODY SHOP INC	6033 BELLE GROVE RD	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	3	5
47	MDD981044647	LORD BALTIMORE CLEANERS	5634 RITCHIE HWY	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	2	3
48	MDD985408640	MARSHALL BODY SHOP	3570 2ND ST	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	2	3
49	MDD985396944	CLASSIC AUTO BODY SPECIALIST	3570 2ND ST	BROOKLYN	MD	21225	3	3	ANNE ARUNDEL	1	1
50	MDD074920968	MATLACK INC	4801 BELLE GROVE RD	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	1	1
51	MDD053940177	MODERN TRASHMOVAL INC	901 BALTIC AVE	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	2	3
52	MDD980554406	MORLOCK PETROLEUM EQUIPMENT SVC INC	4700 BELLE GROVE RD BLDG 16	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	1	1
53	MDD985379205	NEENAN BUSINSS FORMS	3917 S HANOVER ST	BALTIMORE	MD	21225	3	3	ANNE ARUNDEL	1	1

Dun and Bradstreet Facility Data

Dunn & Bradstreet Zip code 21226

n FINDS?

3 PGS

TABLE 2 FACILITIES WITH POTENTIAL ENVIORNMENTAL RELEASES IN ZIP CODE 21226

	A	B	C	D	E	F	G	H	I	J	K
1	COMPANY NAME	ADDRESS	CITY	STATE	ZIP	TEL	SIC CODE	BUSINESS DESCRIPTION	SALES	TOTAL EMPLOYEES	NAME OF OWNER
3	A SMITH & SONS	PENNINGTON AVE	BALTIMORE	MD	212261620	4103557626	3731	SHIPBLDING REPAIRN	$252,411	4	JOSEPH G SMITH
4	ACME PLATING COMPANY INC	BENHILL AVE	BALTIMORE	MD	212261434	4103556821	3471	PLATING POLISHING	$500,000	8	GEORGE SCHUMANN JR
5	AGRO MOTORS INC	FORT SMALLWOOD RD	BALTIMORE	MD	212261802	4103543900	5012	AUTO OTHR MTR VHCLS	$150,000	2	MICHAEL AGRO
6	AIRCO INDUSTRIAL GAS INC	GILDDEN RD	BALTIMORE	MD	212261803	4103541613	5169	CHEM ALLD PRDTS N	$300,000	3	
7	AIRSEAL MANUFACTURING CO INC	CURTIS AVE	BALTIMORE	MD	212261402	4103543971	3442	MTL DOORS SASH TR	$35,000	5	LOUIS ROMM
8	ALLIANCE REG & SHEET MTL INC	PENNINGTON AVE	BALTIMORE	MD	212261423	4103548001	1761	RFNG SDNG SHT MTL	$4,561,641	45	DAVID COBB
9	ALVEYS TRUCK TIRE & TRLR REPR	ARUNDEL COVE AVE	BALTIMORE	MD	212261703	4107895506	7538	GNRL ATMTVE RPR SHP	$200,000	4	JOHN L ALVEY
10	ALVEYS TRUCK TIRES & TRAILER	ARUNDEL COVE AVE	BALTIMORE	MD	212261703	4107895506	7534	TIRE RTRDNG RPR SH	$190,000	3	DINKY ALVEY
11	AMERADA HESS CORPORATION	PENNINGTON AVE	BALTIMORE	MD	212261619	4103550700	5171	PETRO BLK STNS TMN	$0	0	FRED FLINT
12	AMOCO OIL COMPANY	PENNINGTON AVE	BALTIMORE	MD	212261618	4103555112	4225	GENRL WRHSG STORAG	$0	0	CHRIS HIGGS
13	ATLANTIC WELDERS INC	PENNINGTON AVE	BALTIMORE	MD	212261617	4103551869	7692	WELDING REPAIR	$2,422,735	30	CHARLES KEN HARRIS
14	ATLANTIC WELDERS INC	ON ST	BALTIMORE	MD	21226		7692	WELDING REPAIR	$0	0	
15	ATOTECH USA INC	CHESAPEAKE AVE	BALTIMORE	MD	212261012	4103553700	2899	CHEM PRPRTNS NEC	$0	0	RONALD PELLETIER
16	AUTOMATED PLATING INDUSTRIES	BENHILL AVE	BALTIMORE	MD	212261434	4103554700	3471	PLATING POLISHING	$750,000	15	CHARLES MISERENDINO
17	BALTIMORE GAS AND ELECTRIC CO	BRANDON SHORES RD	BALTIMORE	MD	212261746	4107875300	4911	ELECTRIC SERVICES	$0	0	R W LOWMAN
18	BALTIMORE SCRAP CORP	CARBON AVE	BALTIMORE	MD	212261007	4103554455	5093	SCRAP WASTE MTRLS	$4,300,000	27	DAVID SIMON
19	BAY INSTRUMENTATION & TECH	PITTMAN RD	BALTIMORE	MD	212261721	4107890436	3826	ANALYTCL INSTRMNTS	$0	0	
20	BIOMECHANICAL RESOURCES INC	BENHILL AVE	BALTIMORE	MD	212261434	4103542424	3842	SRGCL APPL SUPPLS	$183,224	6	JOHN SENATORE
21	BOYERS AMOCO STATION	FORT SMALLWOOD RD	BALTIMORE	MD	212261717	4103600359	5541	GASLNE SVC STATIONS	$1,100,000	10	
22	BROWNING FERRIS INC	QUANTINE RD	BALTIMORE	MD	21226	4103550196	4953	REFUSE SYSTEMS	$0	0	JOHN SGANGA
23	BROWNING FERRIS INC	CHEMICAL RD	BALTIMORE	MD	212261622		4953	REFUSE SYSTEMS	$0	0	PEGGY O'NEIL
24	BRUCE P MURDOCK INC	3815 LEO ST	BALTIMORE	MD	21226	4103557788	7699	REPAIR SVCS NEC	$812,510	7	TIMOTHY S MURDOCK
25	BUILT RITE SERVICES	E PATAPSCO AVE	BALTIMORE	MD	212261158	4103542532	7538	GNRL ATMTVE RPR SHP	$140,000	3	
26	BULLET TRAILERS & FABRICATION	HAWKINS POINT RD	BALTIMORE	MD	212261610	4103563641	5561	RCRTNL VHCLE DLRS	$137,132	1	MIKE ROGERS
27	BOC GROUP INC A DELAWARE CORP	FORT ARMISTEAD RD	BALTIMORE	MD	212261803	4103541884	2813	INDUSTRIAL GASES	$0	0	PATRICK SMITH
28	BOC GROUP INC A DELAWARE CORP	E PATAPSCO AVE	BALTIMORE	MD	212261523	4103550624	2813	INDUSTRIAL GASES	$0	0	AL KELLER
29	BP AMERICA INC	NORTHBRIDGE AVE	BALTIMORE	MD	212261536	4103557200	5171	PETRO BLK STNS TMN	$0	0	RANDY ROBERTS
30	CAMPBELL BODY	LEO ST	BALTIMORE	MD	212261521	4103557621	7538	GNRL ATMTVE RPR SHP	$140,000	3	
31	CENTRAL OIL ASPHALT CORP	ASIATIC AVE	BALTIMORE	MD	212261506	4103556363	2951	ASPH PVNG MXT BLCK	$0	0	ROBERT A SHANK
32	CHEMETALS INCORPORATED	PITTMAN RD	BALTIMORE	MD	212261792	4107898800	2819	IND INORG CHEM NEC	$60,000,000	285	RICHARD L MULHOLLAND
33	CHEMETALS INCORPORATED	PITTMAN RD	BALTIMORE	MD	212261792	4107898800	2819	IND INORG CHEM NEC	$0	0	RICHARD MULHOLLAND
34	CHESAPEAKE COATING INC	BENHILL AVE	BALTIMORE	MD	212261434	4103554200	3479	MTL CTNG ALLD SVCS	$1,700,000	9	GEORGE SCHUMANN JR
35	CHESAPEAKE CORPORATION	PITTMAN RD	BALTIMORE	MD	212261721	4107899400	2653	CRRGTD SLD FBR BXS	$0	0	ROBERT S ARGABRIGHT
36	CHESAPEAKE CORPORATION	PITTMAN RD	BALTIMORE	MD	212261721	4107899440	5093	SCRAP WASTE MTRLS	$0	0	GREG ISAAC
37	CHESAPEAKE PRINTING & MAILING	E ORDNANCE RD	BALTIMORE	MD	212261741	4107688757	2752	COMMRCL PRTNG LITH	$1,000,000	17	GARY RANKIN
38	CHESAPEAKE PRINTING & MAILING	E ORDNANCE RD STE 40	BALTIMORE	MD	212261741	4107660008	2759	COMMRCL PRINTNG NE	$0	20	GARY RANKIN
39	CHESAPEAKE VENTURE INC	CHESAPEAKE AVE	BALTIMORE	MD	212261051	4106251370	4491	MARINE CARGO HNDLNG	$1,500,000	2	WILLIAM KROH
40	CHEVRON USA INC	CHESAPEAKE AVE	BALTIMORE	MD	212261013	4105763795	5032	BRCK STN RLTD MTR	$0	0	JAMES D FREDERICK
41	CITY OF BALTIMORE	ASIATIC AVE	BALTIMORE	MD	212261507	4103962800	4953	REFUSE SYSTEMS	$0	0	BURTON D SKLAR
42	CLEAN AMERICA INC	CHILDS ST	BALTIMORE	MD	212261016	4103540751	4953	REFUSE SYSTEMS	$4,000,000	39	CURTIS COLICHER
43	COLONIAL PIPELINE COMPANY	FAIRFIELD RD	BALTIMORE	MD	212261516	4103558155	4613	RFND PETRO PPELINES	$0	0	TOM TILLER
44	COLOR PRELUDE INC	ENERGY PKY	BALTIMORE	MD	212261733	4104377725	2844	TOILET PREPARATIONS	$0	0	STAN GARLAND
45	COLUMBIA FLEET SERVICE INC	COVE AVE	BALTIMORE	MD	212261607	4107968795	7538	GNRL ATMTVE RPR SHP	$140,000	3	
46	COMILOG US INC	PITTMAN RD	BALTIMORE	MD	212261792	4107898800	2819	IND INORG CHEM NEC	$85,000,000	430	RICHARD MULHOLLAND
47	COMMERCIAL EQUIPMENT COMPANY	NORTHBRIDGE AVE	BALTIMORE	MD	212261536	4104850399	7538	GNRL ATMTVE RPR SHP	$0	0	
48	COMMERCIAL TESTING & ENGRG CO	ENERGY PKY STE 1002	BALTIMORE	MD	212261798	4102558688	8731	COMMRCL PHYS RSRCH	$0	0	BILLY L GREER
49	CONTRACT MATERIALS PROCESSING	BENHILL AVE	BALTIMORE	MD	212261433	4103541600	5169	CHEM ALLD PRDTS N	$1,800,000	11	DR EDWIN ALBERS
50	CORROSION REPAIR & SERVICES	PENNINGTON AVE	BALTIMORE	MD	212261430	4103552838	1799	SPCL TRD CNTRS NEC	$1,400,000	22	CHET ZANESKI
51	COTTMAN COMPANY	CARBIDE RD	BALTIMORE	MD	212261704	4106317891	4491	MARINE CARGO HNDLNG	$390,000	4	DAVID H MURDOCK

F-16

not elsewhere classified

MDE Facility Data

MDE Facility Data

Facility Name:	FMC Corp.
Street Address:	1701 East Papatsco Ave.
City:	Baltimore
County:	
Zip:	21226
Contact Name:	Michael Altman
Contact Ph.#s:	(410) 354-5706
IMDE Permit #	24-00073
SIC code(s):	2879
Type of Business:	Agricultural Chemical Mfg.
Latitude:*	
Longitude*:	
Census Tract #	250500
Emission Rate:	
Process/Equipment Generating Emission (MDE Code)	24-0073-2-0209
Emission Control Equipment Present? (Yes/no)	Yes
Total Amounts Emitted in Prior Years	
Enforcement/Compliance History (RTKnet)	
Data Element for any onsite monitoring capacity and information:	
Source Category:	Incinerator (Hg3 Waste)
StackHeight:	52 ft.
Stack: Elevation of Stack Base (meters)	
Stack Exit Velocity:	25 fps
Stack Inner Diameter:	40 in.
Stack Exit Temp.:	120°F
Stack: Height of Adj. Bldg.	
Stack: Width of Adj. Bldg.	
Stack:Length of Adj. Bldg.	
Fugitive:Elevation of Area Source	
Fugitive:Effective Emission Height of Area Source	
Fugitive:Width of Square Area Source	

* UTM: Zone 18; Easting 3636; Northing 4343.3

APPENDIX G

Example of Database Columns Developed for the Community Pilot Project Air Emissions Database

Column	Column Header
B	Name
C	Street Address
D	City
E	County
F	ZIP Code
G	Contact Name
H	Contact Phone Number
I	SIC Code(s)
J	Type of Business
K	Latitude
L	Longitude
M	MDE Coordinate East
N	MDE Coordinate North
O	Census Tract Number
P	TRI Facility ID Number
Q	MDE Permit Number
R	Number of Employees
S	Pollutant Name (*=on-site monitoring)
T	CAS Number
U	Carcinogen (Y/N)
V	TRI Chemical (X=Yes)
W	OSHA Chemical (X=Yes)
AB	Cancer Slope Factor (QSTAR) (mg/kg/day)
AD	Reference Concentration (RfC) (mg/m^3)
AE	Inhalation Cancer Slope Factor mg/kg-day
AF	Inhalation Reference Dose (RfD) mg/kg-day
AG	Reference Dose (RfD) mg/kg/day
AN	Total Air Emissions (tons/yr) (1994) TRI
AO	Total Air Emissions (lbs/yr) (1994) TRI
AP	Total Air Emissions (tons/yr) (1995) MDE
AQ	Total Air Emissions (lbs/yr) (1995) MDE
AR	Total Air Emissions (tons/yr) TAP
AS	Total Air Emissions (lbs/yr) TAP

Column	Column Header
AT	Total Air Emissions (tons/yr) TAP*
AU	Total Air Emissions (lbs/yr) TAP*
AV	Maximum Total Air Emissions (lbs/yr)
AW	Potential Dose (mg/kg-day) Turner - Vent
AY	Risk (dose*SF) (based on Turner)
AZ	Hazard (dose/RfD) (based on Turner)
BC	Stack Emissions (lbs/yr) (1995)
BD	Stack Emissions (1995) tons/yr
BE	Fugitive Emissions (lbs/yr) (1995)
BF	Fugitive Emissions (1995) tons/yr
BG	Monitored Concentrations (ppb) Avg. (Max.) 1996
BI	Primary Data Source
BQ	Enforcement Compliance History (RTKNET)

Emission Inventory Database (Few Pages From the Database as example)

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1												MDE Coord East	MDE Coord North	Census Tract #
2	Name	Street Address	City	County	Zip	Contact Name	Contact Ph #s	SIC Code	Type of Business	Latitude	Longitude			
3	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
4	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
5	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
6	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
7	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
8	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
9	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
10	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
11	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
12	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
13	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
14	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
15	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
16	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
17	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
18	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
19	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
20	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
21	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
22	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
23	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
24	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
25	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
26	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
27	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
28	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
29	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
30	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
31	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
32	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
33	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
34	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
35	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
36	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
37	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
38	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
39	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
40	FMC Agricultural Chemical	1701 East Patapsco Ave	Baltimore		21226	John Sanderson	410-355-6400	2869, 5191	Farm Supplies	39 2321	76 5843	919	509	250500
41	Rhone-Poulenc Specialty Chemicals	3440 Fairfield Rd	Baltimore		21226	Itshak Rosner	410-355-2600	2869		39 2358	76 5785			
42	Rhone-Poulenc Specialty Chemicals	3440 Fairfield Rd	Baltimore		21226	Itshak Rosner	410-355-2600	2869		39 2358	76 5785			
43	Rhone-Poulenc Specialty Chemicals	3440 Fairfield Rd	Baltimore		21226	Itshak Rosner	410-355-2600	2869		39 2358	76 5785			
44	Rhone-Poulenc Specialty Chemicals	3440 Fairfield Rd	Baltimore		21226	Itshak Rosner	410-355-2600	2869		39 2358	76 5785			
45	Rhone-Poulenc Specialty Chemicals	3440 Fairfield Rd	Baltimore		21226	Itshak Rosner	410-355-2600	2869		39 2358	76 5785			
46	Rhone-Poulenc Specialty Chemicals	3440 Fairfield Rd	Baltimore		21226	Itshak Rosner	410-355-2600	2869		39 2358	76 5785			
47	Rhone-Poulenc Specialty Chemicals	3440 Fairfield Rd	Baltimore		21226	Itshak Rosner	410-355-2600	2869		39 2358	76 5785			
48	Rhone-Poulenc Specialty Chemicals	3440 Fairfield Rd	Baltimore		21226	Itshak Rosner	410-355-2600	2869		39 2358	76 5785			
49	Rhone-Poulenc Specialty Chemicals	3440 Fairfield Rd	Baltimore		21226	Itshak Rosner	410-355-2600	2869		39 2358	76 5785			
50	Rhone-Poulenc Specialty Chemicals	3440 Fairfield Rd	Baltimore		21226	Itshak Rosner	410-355-2600	2869		39 2358	76 5785			
51	Rhone-Poulenc Specialty Chemicals	3440 Fairfield Rd	Baltimore		21226	Itshak Rosner	410-355-2600	2869		39 2358	76 5785			
52	Rhone-Poulenc Specialty Chemicals	3440 Fairfield Rd	Baltimore		21226	Itshak Rosner	410-355-2600	2869		39 2358	76 5785			
53	Rhone-Poulenc Specialty Chemicals	3440 Fairfield Rd	Baltimore		21226	Itshak Rosner	410-355-2600	2869		39 2358	76 5785			
54	Rhone-Poulenc Specialty Chemicals	3440 Fairfield Rd	Baltimore		21226	Itshak Rosner	410-355-2600	2869		39 2358	76 5785			
55	Atotech U S A	1900 Chesapeake Ave	Baltimore		21226-1012	Ronald Pelletier	410-355-3700	2819, 2899		39 2386	76 5724	913	512	250600
56	Atotech U S A	1900 Chesapeake Ave	Baltimore		21226-1012	Ronald Pelletier	410-355-3700	2819, 2899		39 2386	76 5724	913	512	250600
57	Atotech U S A	1900 Chesapeake Ave	Baltimore		21226-1012	Ronald Pelletier	410-355-3700	2819, 2899		39 2386	76 5724	913	512	250600
58	Atotech U S A	1900 Chesapeake Ave	Baltimore		21226-1012	Ronald Pelletier	410-355-3700	2819, 2899		39 2386	76 5724	913	512	250600
59	Atotech U S A	1900 Chesapeake Ave	Baltimore		21226-1012	Ronald Pelletier	410-355-3700	2819, 2899		39 2386	76 5724	913	512	250600

A	P	Q	R	S	T	U	V	W	AB	AD	AE	AF
1	TRI Facility ID #	MDE Permit #	Number of Employees	Pollutant Name (*=on-site monitoring)	CAS #	Carcinogen (Y/N) [For source see column AJ]	TRI Chemical	OSHA*	Cancer Slope Factor QSTAR (q1*) (mg/kg-day)-1	Reference Concentration (RfC) mg/m3	Inhalation Cancer Slope Factor (mg/kg-day)-1	Inhalation Reference Dose (RfD) mg/kg-day
2	21226FMCCR1701E		285	Acetic acid, methyl ester, methyl acetate	79209				0	0		
3	21226FMCCR1701E		285	Acetone	67641	N (R)	delisted		0	0		
4	21226FMCCR1701E		285	Acetonitrile	75058	Y-Inhal (R)	X	X	0	0 05		0 0143
5	21226FMCCR1701E		285	Ammonia	7664417	N (S)	X		0	0 1		0 0286
6	21226FMCCR1701E		285	Benzene	71432	Y-Inhal (R)	X	X	0 029	0	0 029	0 00171
7	21226FMCCR1701E		285	Benzoyl peroxide	94360		X		0	0		
8	21226FMCCR1701E		285	Carbon monoxide (CO)	630080				0	0		
9	21226FMCCR1701E		285	Carbon tetrachloride	56235	Y-Inhal (R)	X	X	0 13	0	0 0525	0 000571
10	21226FMCCR1701E		285	Catechol	120809		X		0	0		
11	21226FMCCR1701E		285	Chlorine	7782505	N (R)	X		0	0		
12	21226FMCCR1701E		285	Chloroform (Trichloromethane)	67663	Y-Inhal (R)	X	X	0 0061	0	0 0805	
13	21226FMCCR1701E		285	Chloromethane (Methyl chloride)	74873	Y-Inhal (R)	X		0	0	0 0063	
14	21226FMCCR1701E		285	Cyanide & compounds	57125				0	0		
15	21226FMCCR1701E		285	Ethanol (Ethyl alcohol)	64175				0	0		
16	21226FMCCR1701E		285	Ethion	563122				0	0		
17	21226FMCCR1701E		285	Ethylbenzene	100414	N (R) (S)	X		0	1		0 286
18	21226FMCCR1701E		285	Ethylene glycol	107211	N (R)	X		0	0		
19	21226FMCCR1701E		285	Heptane	142825				0	0		
20	21226FMCCR1701E		285	Hydrochloric acid (Hydrogen chloride)	7647010	N (S)	X		0	0 02		0 00571
21	21226FMCCR1701E		285	Hydrogen cyanide (Hydrocyanic acid)	74908		X		0	0 003		0 000857
22	21226FMCCR1701E		285	Hydrogen peroxide	7722841				0	0		
23	21226FMCCR1701E		285	Isopropyl alcohol	67630		X		0	0		
24	21226FMCCR1701E		285	Methanol	67561	N (R) (S)	X		0	0		
25	21226FMCCR1701E		285	Methyl isobutyl ketone	108101	N (R) (S)	X		0	0 08		0 0229
26	21226FMCCR1701E		285	Methylene bromide	74953		X		0	0		
27	21226FMCCR1701E		285	Nitrogen oxides (NOx)	0-01-1							na
28	21226FMCCR1701E		285	Nitrophenol-2 (Nitrophenol o-)	88755		X		0	0		
29	21226FMCCR1701E		285	Particulates	0-01-2							na
30	21226FMCCR1701E		285	Phenol	108952		X		0	0		
31	21226FMCCR1701E		285	Phosphoric acid	7664382	N (R) (S)	X		0	0 01		0 00286
32	21226FMCCR1701E		285	Pyridine	110861	Y (R)	X		0	0		
33	21226FMCCR1701E		285	Sodium cyanide (Na(CN))	143339				0	0		
34	21226FMCCR1701E		285	Sodium hydroxide	1310732				0	0		
35	21226FMCCR1701E		285	Sodium sulfate (solution)	7757826				0	0		
36	21226FMCCR1701E		285	Sulfur oxides (SOx)	0-01-3							na
37	21226FMCCR1701E		285	Sulfuric acid	7664939	N (S)	X		0	0		
38	21226FMCCR1701E		285	Toluene	108883	N (R)	X		0	0 4		0 114
39	21226FMCCR1701E		285	Volatile Organic Compounds (VOCs)	0-01-4							na
40	21226FMCCR1701E		285	Xylene	1330207	N (R) (S)	X		0	0		
41	21226LCLC 3440F		105	Acrylic acid	79107	N (R) (S)	X		0	0 001		0 000286
42	21226LCLC 3440F		105	Ammonia	7664417	N (S)	X		0	0 1		0 0286
43	21226LCLC 3440F		105	Carbon monoxide (CO)	630080				0	0		
44	21226LCLC 3440F		105	Dioxane (1 4-)	123911		X		0 011	0		
45	21226LCLC 3440F		105	Ethylene oxide	75218	Y (R)	X	X	1 02	0	0 35	
46	21226LCLC 3440F		105	Formaldehyde	50000	Y (R) (S)	X	X	0 045	0	0 0455	
47	21226LCLC 3440F		105	Glycol ethers	0 00-5							na
48	21226LCLC 3440F		105	Hydrochloric acid (Hydrogen chloride)	7647010	N (S)	X		0	0 02		0 00571
49	21226LCLC 3440F		105	Isopropyl alcohol	67630		X		0	0		
50	21226LCLC 3440F		105	Methanol	67561	N (R) (S)	X		0	0		
51	21226LCLC 3440F		105	Nitrogen oxides (NOx)	0-01-1							na
52	21226LCLC 3440F		105	Sulfur oxides (SOx)	0-01-3							na
53	21226LCLC 3440F		105	Sulfuric acid	7664939	N (S)	X		0	0		
54	21226LCLC 3440F		105	Volatile Organic Compounds (VOCs)	0-01-4							na
55				Carbon monoxide (CO)	630080				0	0		
56	21226MTCHM1900C			Chromium & compounds	7440473	Y-Inhal (R)	X		0	0 0005	4 20E+001	0 000000571
57	21226MTCHM1900C			Nitric acid	7697372	N (S)	X		0	0		
58				Nitrogen oxides (NOx)	0-01-1							na
59	21226MTCHM1900C			Zinc & compounds (fume or dust)	7440666	N (R) (S)	X					

Emission Inventory Database (Few Pages From the Database as example)

A	AG	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AY
1	Reference Dose (RfD) mg/kg/day	Total Air Emissions (tons/yr) (1994) TRI	Total Air Emissions (lbs/yr) (1994) TRI	Total Air Emissions (tons/yr) (1995) MDE	Total Air Emissions (lbs/yr) (1995) MDE	Total Air Emissions (tons/yr) (?) TAP	Total Air Emissions (lbs/yr) (?) TAP	Total Air Emissions (tons/yr) (?) TAP*	Total Air Emissions (lbs/yr) (?) TAP*	Maximum Total Air Emissions (lbs/yr)	Potential Dose (mg/kg-day) Turner - Vent	Risk (dose*SF) (based on Turner)
2	1					0 2001	400 2			400 2	0 0003055095794	0 00E+000
3	0 1					1 086	2172			2172	0 0016580879723	0 00E+000
4	0 006	0 1785	357			2 185	4370			4370	0 0033360241431	0 00E+000
5	0	0 1945	389			0 0131	26 2			389	0 0002969595862	0 00E+000
6	0 003					0 1752	350 4			350 4	0 0002674926452	7 76E-006
7	0					0 0013	2 6			2 6	0 0000019848199	0 00E+000
8	0			14 67	29340					29340	0 022397928686	0 00E+000
9	0 0007	0 0915	183			0 8935	1787			1787	0 0013641819551	7 16E-005
10	0	0 0055	11			0 3257	651 4			651 4	0 0004972737132	0 00E+000
11	0 1	10 8075	21615			0 1156	231 2			21615	0 0165007235361	0 00E+000
12	0 01					0 0902	180 4			180 4	0 0001377159623	1 11E-005
13	0	0 091	182			2 3392	4678 4			4678 4	0 0035714543137	2 25E-005
14	0 02	0 0005	1			0 0357	71 4			71 4	0 0000545062068	0 00E+000
15	0					12 598	25196			25196	0 019234431192	0 00E+000
16	0 0005							0 00004	0 08	0 08	0 0000000610714	0 00E+000
17	0 1	0 0375	75			0 8864	1772 8			1772 8	0 0013533417851	0 00E+000
18	2	0 0215	43			1 6114	3222 8			3222 8	0 0024602605511	0 00E+000
19	0					1 855	3710			3710	0 0028321852565	0 00E+000
20	0	22 835	45670			353 904	707808			707808	0 5403351434015	0 00E+000
21	0 02							0 00004	0 08	0 08	0 0000000610714	0 00E+000
22	0							0 00004	0 08	0 08	0 0000000610714	0 00E+000
23	0					0 027	54			54	0 0000412231816	0 00E+000
24	0 5	3 4335	6867			11 6876	23375 2			23375 2	0 0178444465788	0 00E+000
25	0 08	0 3575	715			1 2106	2421 2			2421 2	0 0018483253216	0 00E+000
26	0 01	0 543	1086							1086	0 0008290439861	0 00E+000
27	na			74 77	149540					149540	0 114157677427	0 00E+000
28	0					0 203	406			406	0 0003099372545	0 00E+000
29	na			7 78	15560					15560	0 0118783834477	0 00E+000
30	0 6							0 00004	0 08	0 08	0 0000000610714	0 00E+000
31	0					0 0558	111 6			111 6	0 0000851945754	0 00E+000
32	0 001					0 0486	97 2			97 2	0 0000742017269	0 00E+000
33	0 04							0 00004	0 08	0 08	0 0000000610714	0 00E+000
34	0					0 643	1286			1286	0 0009817224366	0 00E+000
35	0					0 0159	31 8			31 8	0 0000242758736	0 00E+000
36	na			83 82	167640					167640	0 1279750771958	0 00E+000
37	0	0 0005	1			0 004	8			8	0 000006107138	0 00E+000
38	0 2	1 0545	2109			7 8141	15628 2			15628 2	0 0119304467993	0 00E+000
39	na			23 54	47080					47080	0 035940507244	0 00E+000
40	2	0 2955	591			4 924	9848			9848	0 0075178869018	0 00E+000
41	0 5	0 013	26			0 014	28			28	0 0000213749831	0 00E+000
42	0	0 043	86			0 014	28			86	0 0000656517337	0 00E+000
43	0			0 36	720					720	0 0005496424217	0 00E+000
44	0					0 029	58			58	0 0000442767506	0 00E+000
45	0	0 1475	295							295	0 0002252007145	7 88E-005
46	0 2	0 015	30							30	0 0000229017676	1 04E-006
47	na	0 005	10							10	0 0000076339225	0 00E+000
48	0	0 1205	241							241	0 0001839775328	0 00E+000
49	0					0 0665	133			133	0 0001015311696	0 00E+000
50	0 5					0 03	60			60	0 0000458035351	0 00E+000
51	na			1 64	3280					3280	0 0025039265879	0 00E+000
52	na			0 18	360					360	0 0002748212109	0 00E+000
53	0	0 0025	5							5	0 0000038169613	0 00E+000
54	na			5 25	10500					10500	0 0080156186504	0 00E+000
55	0			0 12	240					240	0 0001832141406	0 00E+000
56	0 07	0 0005	1							1	0 0000007633923	3 21E-005
57	0	0 0005	1							1	0 0000007633923	0 00E+000
58	na			8 89	17780					17780	0 013573114248	0 00E+000
59	0 3	0 0005	1							1	0 0000007633923	0 00E+000

G-5

Emission Inventory Database (Few Pages From the Database as example)

A	AZ	BC	BD	BE	BF	BG	BI	BQ
1	Hazard (dose/ RfD) (based on Turner)	Stack Emissions (lbs/yr) (1995)	Stack Emissions (1995) tons/yr	Fugitive Emissions (lbs/yr) (1995)	Fugitive Emissions (1995) tons/ yr	Monitored Emissions (ppb) Avg (Max) 1996	Primary Data Source	Enforcement Compliance History (RTKnet)
2	ERR						TAP	
3	ERR						TAP	
4	0 2332884016						TAP	
5	0 0103832023						TAP	
6	0 1564284475						TAP	
7	ERR						TAP	
8	ERR						1995 MDE Emissions Statement	
9	2 3891102541						TAP	
10	ERR						TAP	
11	ERR						TAP	
12	ERR						TAP	
13	ERR						TAP	
14	ERR						TAP	
15	ERR						TAP	
16	ERR						TAP (reported value=0 0000)	
17	0 0047319643						TAP	
18	ERR						TAP	
19	ERR						TAP	
20	94 629622312						TAP	
21	0 0000712618						TAP (reported value=0 0000)	
22	ERR						TAP (reported value=0 0000)	
23	ERR						TAP	
24	ERR						TAP	
25	0 0807128961						TAP	
26	ERR						1994 TRI Form R	
27	ERR						1995 MDE Emissions Statement	
28	ERR						TAP	
29	ERR						1995 MDE Emissions Statement	
30	ERR						TAP (reported value=0 0000)	
31	0 0297883131						TAP	
32	ERR						TAP	
33	ERR						TAP (reported value=0 0000)	
34	ERR						TAP	
35	ERR						TAP	
36	ERR						1995 MDE Emissions Statement	
37	ERR						TAP	
38	0 1046530421						TAP	
39	ERR						1995 MDE Emissions Statement	
40	ERR						TAP	
41	0 074737703						TAP	
42	0 0022955152						TAP	
43	ERR						1995 MDE Emissions Statement	
44	ERR						TAP	
45	ERR						1994 TRI Form R	
46	ERR						1994 TRI Form R	
47	ERR						1994 TRI Form R	
48	0 0322202334						1994 TRI Form R	
49	ERR						TAP	
50	ERR						TAP	
51	ERR						1995 MDE Emissions Statement	
52	ERR						1995 MDE Emissions Statement	
53	ERR						1994 TRI Form R	
54	ERR						1995 MDE Emissions Statement	
55	ERR						1995 MDE Emissions Statement	
56	1 3369391461						1994 TRI Form R	
57	ERR						1994 TRI Form R	
58	ERR						1995 MDE Emissions Statement	
59	ERR						1994 TRI Form R	

G-6

APPENDIX H

Facilities Modeled for Secondary Screen

Appendix H - Baltimore Facilities and Pollutants Modeled for Secondary Screen

Facility Name	Pollutant Name	Emission Rate (lb/yr)
Amoco Oil Co.	Toluene	9.746
	Benzene	4.000
Baltimore City Composting	Ammonia	206.660
	Benzene	7.156*
	Carbon tetrachloride	2.820
	Toluene	8.436
	Vinyl chloride	5.720
Baltimore Resco	Arsenic	630
	Cadmium	703
	Chromium	3.333
	Formaldehyde	4.355
	Hydrogen chloride	6.126.000
	Hydrogen fluoride	77.651
	Mercury	15.837
Bethlehem Steel	Cadmium	551
	Chromium	848
	Lead	958
	Manganese	20.124
BGE- Brandon Shores	Carbon monoxide	2.114.980
	Nitrogen oxides	45.987.400
	Sulfur oxides	93.865.380
	Arsenic	1.443
	Cadmium	178
	Chromium	909
	Lead	1.468
	Mercury	290
	Nickel	978
	Hydrogen Chloride	4.200.000
	Hydrogen Fluoride	5.200.000
	Dioxins and Furans	0.0062
BGE- Wagner Station	Carbon monoxide	816.140
	Nitrogen oxides	27.567.540
	Sulfur oxides	35.993.240
	Arsenic	462
	Cadmium	64
	Chromium	294
	Lead	477
	Mercury	91
	Nickel	2.167
	Hydrogen Chloride	1.300.000
	Hydrogen Fluoride	160.000
	Dioxins and Furans	0.0019
Bayway Terminal	Benzene	1.120

Facility Name	Pollutant Name	Emission Rate (lb/yr)
Brooklyn Service Station	Toluene	141
Chemetals Corp.	Ammonia	59,568
	Hydrochloric acid	23,172
	Manganese	61,661
	Sulfuric acid	3,621
Citgo Station	Benzene	122
	Toluene	186
CONDEA-Vista Chem.	Benzene	3,000
	Hydrochloric acid	21,000
FMC Agricultural Chemical	Carbon tetrachloride	1,787
	Chloromethane	4,678
	Hydrochloric acid	707,808
	Toluene	15,628
Grace Davison	Ammonia	290,000
	Chromium	122
	Molybdenum trioxide	1,180
	Nitrogen oxides (NOx)	237,780
	Sulfuric acid	3,000
Hobelmann Port Ser.	Stoddard solvent	30,380
J.S. Lee's Body Shop, Inc.	Toluene	263
Med Net/MedX Inc.	Dioxins & Furans	0.00000199
	Hydrochloric acid	42,300
Mobil Oil(Maritank)	Benzene	882
	Toluene	5,291
Norris Farm Landfill	1,2-Dichloropropane	2,365
	Benzene	1,051
	Methyl chloride	2,365
	Methylene chloride	11,388
	Vinyl chloride	2,628
Phoenix Services	Dioxins & Furans	0.00282
	Hydrochloric acid	91,016
Port International	Hydrogen sulfide	2,640
Quebecor Printing	Toluene	3,250,000
SCM Chem.- Millennium	Carbon monoxide (CO)	19,028,940
	Carbonyl sulfide	1,562,400
Millennium (cont.)	Sulfur oxides (SOx)	2,306,640
	Sulfuric acid	39,900
Shell Oil Terminal	Benzene	1,400
	Xylenes (m-,o-,p-)	1,500
MOTIVA	Benzene	130
	Toluene	199
U.S. Coast Guard	Toluene	8,054
U.S. Gypsun	Chromium	26.2

* This number was determined to be erroneous. However, the emissions Did not impact the Partnership neighborhoods.

APPENDIX I

Results of Secondary Screening for Target Toxics

Table I-1. Results of Screening for Target Toxics

Estimated air levels (in micrograms per cubic meter of air ($\mu g/m^3$), based on modeling of facility emissions in four South Baltimore neighborhoods plus the location with the highest estimated air levels. Exposure guidelines and monitoring results data are provided for comparison. The concentration as a percentage of the applicable comparison guideline is shown below the concentration (in parentheses).

Chemical	Screening Comparison Concentrations (standards and guidelines)	Neighborhood Concentrations (from modeling)					State-operated monitoring station results
		Cherry Hill	Brooklyn/ Brooklyn Park	Curtis Bay	Wagners Point	Point with Highest Concentration	
Ammonia	100 $\mu g/m^3$ (EPA guideline- IRIS RfC)	0.073 (<1%)	0.129 (<1%)	0.54 (<1%)	0.23 (<1%)		
Arsenic	Carcinogenic 0.00041 $\mu g/m^3$ Non-carcinogenic 1.1 $\mu g/m^3$	0.00016 (39%) (<1%)	0.0001 (24%) (<1%)	0.00012 (29%) (<1%)	0.0001 (24%) (<1%)		
Benzene	0.22 $\mu g/m^3$ (EPA guideline - derived from IRIS)	0.003 (1%)	0.008 (4%)	0.019 (9%)	**0.19 (86%)**		**3.38 $\mu g/m^3$ (2100%)**
1,3-Butadiene	0.0064 $\mu g/m^3$ (EPA guideline, derived from IRIS)						**0.25 $\mu g/m^3$ (3900%)**
Cadmium	0.00099 $\mu g/m^3$	0.00016 (16%)	0.0001 (10%)	0.0001 (10%)	0.0001 (10%)		
Carbon monoxide	10,000 $\mu g/m^3$ as 8-hour average (EPA NAAQS standard)	1.34 (<1%)	1.87 (<1%)	6.4 (<1%)	2.7 (<1%)		
Carbon tetrachloride	0.12 $\mu g/m^3$ (EPA guideline - derived from IRIS)	0.0008 (<1%)	0.0026 (2%)	0.022 (18%)	0.009 (7%)		**0.96 $\mu g/m^3$ (800%)**
Carbonyl sulfide	1,500 $\mu g/m^3$ (Maryland Standard - Interim Special Screening Level)	0.106 (<1%)	0.149 (<1%)	0.52 (<1%)	0.218 (<1%)		

Table I-1. Results of Screening for Target Toxics (continued)

Chemical	Screening Comparison Concentrations (standards and guidelines)	Neighborhood Concentrations (from modeling)					State-operated monitoring station results
		Cherry Hill	Brooklyn/ Brooklyn Park	Curtis Bay	Wagners Point	Point with Highest Concentration	
Chromium (as Hexavalent form)	0.00015 $\mu g/m^3$ (EPA guideline - derived from IRIS)	**0.0001 (67%)**	**0.0004 (267%)**	**0.0004 (267%)**	**0.0006 (400%)**		
Chromium (as Trivalent form)	0.0021 $\mu g/m^3$	(35%)	(20%)	**(260%)**	(20%)		
1,2-Dichloropropane	0.092 $\mu g/m^3$	0.0002 (<1%)	0.00016 (<1%)	0.0003 (<1%)	0.00024 (<1%)		
Dioxin (2,3,7,8-TCDD)	0.000000054 $\mu g/m^3$ (Equivalent to $5.4x10^{-8}$) (EPA guideline - derived from HEAST)	0.0000000000419 ($4.19x10^{-11}$) (<1%)	0.000000000063 ($6.3x10^{-10}$) (1%)	0.000000000157 ($1.57x10^{-9}$) (3%)	0.000000000097 ($9.7x10^{-10}$) (2%)		
Formaldehyde	0.14 $\mu g/m^3$	0.00089 (<1%)	0.00042 (<1%)	0.0004 (<1%)	0.00034 (<1%)		
Hydrochloric acid	21 $\mu g/m^3$ (EPA guideline - IRIS RfC) 7 $\mu g/m^3$ (Maryland Standard - Acceptable Ambient Level)	1.51 (7%) (22%)	1.51 (7%) (22%)	**3.67 (18%)** **(52%)**	**8.43 (40%)** **(120%)**		
Hydrogen fluoride	25 $\mu g/m^3$ TLV/100	0.09554 (<1%)	0.09875 (<1%)	0.11052 (<1%)	0.10827 (<1%)		
Hydrogen sulfide	1 $\mu g/m^3$	0.00026 (<1%)	0.00036 (<1%)	0.0006 (<1%)	0.00045 (<1%)		
Lead	3.5 $\mu g/m^3$	0.00006 (<1%)	0.00008 (<1%)	0.00011 (1%)	0.00011 (<1%)		
Manganese	0.052 $\mu g/m^3$ (EPA guideline - IRIS RfC)	0.0145 (28%)	0.0244 (47%)	**0.039 (75%)**	**0.0546 (105%)**		

Table I-1. Results of Screening for Target Toxics (continued)

Chemical	Screening Comparison Concentrations (standards and guidelines)	Neighborhood Concentrations (from modeling)					State-operated monitoring station results
		Cherry Hill	Brooklyn/ Brooklyn Park	Curtis Bay	Wagners Point	Point with Highest Concentration	
Mercury	0.31 $\mu g/m^3$	0.00325 (1%)	0.00153 (<1%)	0.00145 (<1%)	0.00125 (<1%)		
Methyl chloride	0.99 $\mu g/m^3$ (EPA guideline - derived from HEAST)	0.001 (<1%)	0.0052 (<1%)	0.051 (5%)	0.02 (2%)		**1.26 $\mu g/m^3$ (127%)**
Methylene chloride	3.8 $\mu g/m^3$	0.00081 (<1%)	0.00078 (<1%)	0.00148 (<1%)	0.00114 (<1%)		
Molybdenum trioxide	18 $\mu g/m^3$ (EPA guideline - derived from IRIS reference dose for molybdenum)	0.0002 (<1%)	0.0003 (<1%)	0.0009 (<1%)	0.001 (<1%)		
Nickel	73 $\mu g/m^3$	0.00007 (<1%)	0.00009 (<1%)	0.00011 (<1%)	0.00011 (<1%)		
Nitrogen oxides	3,700 $\mu g/m^3$ as annual mean not to be exceeded (EPA NAAQS standard)	1.43 (<1%)	1.76 (<1%)	2.2 (<1%)	2.06 (<1%)		
Stoddard solvent	5,250 $\mu g/m^3$ (Maryland standard - ambient air level derived from ACGIH TLV/100)	0.006 (<1%)	0.023 (<1%)	0.133 (<1%)	0.044 (<1%)		
Sulfur oxides	80 $\mu g/m^3$ as annual mean (EPA NAAQS standard)	2.48 (3%)	3.0 (4%)	3.93 (5%)	3.5 (4%)		
Sulfuric acid	10 $\mu g/m^3$ (Maryland standard - ambient air level derived from ACGIH TLV/100)	0.004 (<1%)	0.005 (<1%)	0.015 (<1%)	0.008 (<1%)		
Toluene	420 $\mu g/m^3$ (EPA guideline -IRIS RfC)	2.361 (<1%)	2.924 (<1%)	2.605 (<1%)	3.101 (<1%)		12.22 $\mu g/m^3$ (3%)

Table I-1. Results of Screening for Target Toxics (continued)

Chemical	Screening Comparison Concentrations (standards and guidelines)	Neighborhood Concentrations (from modeling)					State-operated monitoring station results
		Cherry Hill	Brooklyn/ Brooklyn Park	Curtis Bay	Wagners Point	Point with Highest Concentration	
Vinyl chloride	0.021 $\mu g/m^3$ (EPA guideline - derived from HEAST)	0.001 (5%)	0.002 (8%)	0.006 (27%)	0.003 (13%)		0.00 $\mu g/m^3$ (0%)
Xylene	7,300 $\mu g/m^3$ (ATSDR guideline - chronic MRL)	0.0003 (<1%)	0.001 (<1%0	0.031 (<1%)	0.002 (<1%)		27.17 $\mu g/m^3$ (0.4%)

Table I-2. Evaluation of Combined Exposures for Substances Known to Cause Respiratory Effects

Concentrations and percentages of guidelines for each substance, along with a sum of the individual percentages to provide an estimate of the possible impact from simultaneous exposures

Chemical	Screening Comparison Concentrations (standards and guidelines)	Neighborhood Concentrations (from modeling)					State-operated monitoring station results
		Cherry Hill	Brooklyn/ Brooklyn Park	Curtis Bay	Wagners Point	Point with Highest Concentration	
RESPIRATORY EFFECTS							
Ammonia	100 $\mu g/m^3$ (EPA guideline- IRIS RfC)	0.073 (<1%)	0.129 (<1%)	0.54 (<1%)	0.23 (<1%)	Not applicable	
Formaldehyde	120 $\mu g/m^3$	0.00089 (<1%)	0.00042 (<1%)	0.0004 (<1%)	0.00034 (<1%)		
Hydrochloric acid	20 $\mu g/m^3$ (EPA guideline - IRIS RfC) 7 $\mu g/m^3$ (Maryland Standard - Acceptable Ambient Level)	1.51 (7%) (22%)	1.51 (7%) (22%)	**3.67 (18%)** **(52%)**	**8.43 (40%)** **(120%)**	Not applicable	
Hydrogen fluoride	25 $\mu g/m^3$ TLV/100	0.09554 (<1%)	0.09875 (<1%)	0.11052 (<1%)	0.10827 (<1%)		
Nitrogen dioxide	3,700 $\mu g/m^3$ as annual mean not to be exceeded (EPA NAAQS standard)	1.43 (<1%)	1.76 (<1%)	2.2 (<1%)	2.06 (<1%)	Not applicable	
Sulfur dioxide	80 $\mu g/m^3$ as annual mean (EPA NAAQS standard)	2.48 (3%)	3.0 (4%)	3.93 (5%)	3.5 (4%)	Not applicable	
Sulfuric acid	10 $\mu g/m^3$ (Maryland standard - ambient air level derived from ACGIH TLV/100)	0.004 (<1%)	0.005 (<1%)	0.015 (<1%)	0.008 (<1%)	Not applicable	
Total Respiratory Effects	Using higher limits Using lower limit	<15% <30%	<16% <31%	**<27%** **<61%**	**<50%** **<130%**	Not applicable	

APPENDIX J

Partnership Air Committee Report

November 9, 1999 Draft
Report from the Partnership Air Committee

1. What is this report?

For the past several years the Air Committee of the Community Environmental Partnership (CEP) has been working to get a better understanding of the air quality in south Baltimore and northern Anne Arundel County. The first step of this effort has now been completed. This report summarizes the work that has been done and the steps planned for the future. Supporting data is available in a full technical report.

2. What is the Air Quality Committee of the South Baltimore Community Environmental Partnership?

The Air Committee is one of five committees organized by the CEP to get a better understanding of the environment and economy in south Baltimore and northern Anne Arundel County. A list of Air Committee members and their affiliation is attached to this report. The job of the Air Committee is to collect information on the quality of the air in the Partnership neighborhoods and make suggestions for how the air quality can be improved. Air quality ranked first in the list of concerns voted on at the July, 1996, community meeting that began the Partnership. This high interest in air quality is an indication of the widespread community concern about the health of the community in the Partnership neighborhoods and the possible contribution of the environment to those health concerns. The CEP Air Committee has about twenty members including local residents, industry managers and officials from the U.S. EPA, the Maryland Department of Environment (MDE), Baltimore City, Anne Arundel County, and The Johns Hopkins University. All committee members are committed to work together to improve the air quality in the Partnership neighborhoods. The committee has met regularly since its inception. Meetings have been held at the Partnership Office since its opening in March, 1997. Meetings are open to the public.

3. What aspects of air quality were studied?

Many community members believe that chronic health problems in Partnership neighborhoods, especially certain types of cancers, may be attributed to outdoor air pollutants released by the factories, utilities, waste facilities and vehicles in and around the Partnership area. Since certain chronic health problems may be caused by long-term exposure to these pollutants, the committee decided to start its work by studying annual ambient concentrations of outdoor air pollutants in Partnership neighborhoods from these sources.

It is important to note, that there are three other aspects of air quality that may have significant chronic health effects that were not a part of this study: ground level ozone, which is a byproduct of the reaction of certain chemicals with sunlight; small particulate matter, especially from diesel exhaust; and short term peak concentrations of certain chemicals that may contribute to health

problems such as asthma. The Air Committee has recommended further work in these areas to evaluate their potential effects on the community. See recommendations in Question 12 below

4. What chemicals are present in outdoor air and where do they come from?

The committee reviewed emission reports from over 125 facilities in and around the Partnership area and air monitoring reports from MDE. 175 chemicals released to, or measured in, the outdoor air in the Partnership neighborhoods were identified during this review. The chemicals originate from a wide variety of sources, including factories, utilities, waste facilities and vehicles.

5. How were the chemicals in outdoor air evaluated?

Given the resources available, the Air Committee decided to use a screening method that could provide the community with information to help identify chemicals that might be a concern. The Committee screening method used two kinds of available information. First, the Committee used available information on air pollutant concentrations from the state air monitoring station located in Fairfield, north of the FMC facility. This is the only air monitoring station located in the Partnership neighborhoods that gathers information on air pollutants. This monitoring station takes air samples every day. Records of the ambient concentrations of 41 different chemicals are available from these samples. The second kind of information used for the screening analysis was the information on air emissions reported by facilities to the EPA's Toxics Release Inventory and to the Maryland Department of Environment under the state permitting program. The Committee used air dispersion computer modeling to estimate the concentrations of air toxics in Partnership neighborhoods that result from these permitted emissions. At the request of the community for information on the possible effects from multiple sources, the Committee used current EPA modeling methodology to combine all the sources for each chemical to get an estimate of the aggregate exposure levels in each Partnership neighborhood. For example, there are twenty stationary sources of benzene in and around the Partnership neighborhoods. These sources were combined in the modeling program to provide an estimate of the total benzene concentration in each neighborhood.

Both the concentrations measured at the monitoring station and the estimated concentrations from area facilities were compared to "screening values" chosen by the committee. A screening value is an air concentration that the committee is confident does not pose a significant human health risk. The committee used U.S. EPA and MDE health effects information to select a screening value for each chemical. Screening values can be based on either cancer risks or risks from other toxic effects. All of the screening values used in this study are based on cancer risk because these offered the most protective values (i.e. the lowest corresponding concentrations) for the subject chemicals. For each chemical, the Committee chose a screening value that corresponds to an increased cancer risk of one in one million under the assumed conditions of exposure. This is consistent with risk management goals used by various EPA programs, including the ambient air program. For pollutants that may cause cancer, EPA programs use a risk management range of one in one million to one in ten thousand under their reasonable maximum exposure scenarios to guide their decision-making. The screening values used in this analysis are not enforceable standards and were used for committee screening purposes only. Enforceable State standards are

applied to individual facilities and are based on an increased cancer risk of one in one hundred thousand outside the facility. The Committee screening values are more conservative than the State standards and cannot be directly compared. Once screening values were chosen, the Committee compared them to the measured and modeled concentrations in the Partnership neighborhoods. All neighborhood chemical air concentrations found above the screening values are identified in this report. They are discussed in question seven below.

6. What community questions can and cannot be answered with this information?

It is important to recognize that there are limitations to the information that this kind of screening analysis can provide. Most significantly, a study of this kind cannot tell the community what the actual risks from these chemicals are in each of the Partnership neighborhoods. This is true because much of the screening is based on estimates and not on actual measurements, because the actual measurements were taken only in Fairfield and not in all of the Partnership neighborhoods, and because no study was made of the people living in our neighborhoods to get a better idea of their actual exposure. This would take into consideration things like the time spent in the neighborhood, ages, time spent outdoors, etc. The Air Committee decided that collecting all the information necessary for a more detailed risk analysis would be both expensive and time consuming and may not add that much to the community's ability to set priorities. (See section Question 11 for more background on the limitations of the method used.)

Finally, the Air Committee air screening exercise does not provide sufficient information to explain current or future incidences of cancer and other diseases in the Partnership neighborhoods. There are many contributing factors affecting community health that were not considered in this study. These include things like lifestyle, diet, smoking, access to medical care, and heredity. In addition, the Air Committee looked only at current levels of chemicals, not at exposures that occurred ten or twenty years ago when ambient air pollutant emissions and ambient concentrations were higher than today's levels. Current incidences of cancer may be caused, in part, by these past exposures. It is also important to recognize that the analysis in this report is based on the assumption that reduced emissions are associated with reduced risk.

Despite the limitations, the screening analysis provides valuable information to the community. The analysis identifies and inventories all the significant commercial, industrial, and waste treatment and disposal facility sources of chemicals in outdoor air in the Partnership neighborhoods. It provides the best estimates available on the types and amounts of chemicals in outdoor air in Partnership neighborhoods, including estimates of the aggregate concentrations of the same chemical from multiple sources. The analysis compares the estimated and measured concentrations to health values and provides enough risk information to help the community set priorities and chart an effective course of action for improving air quality. It also helps to establish a community air quality baseline that can be used to evaluate future progress and identify potential concerns with new sources. The analysis also allows the Partnership to compare the levels in its neighborhoods to other urban, suburban and rural neighborhoods where the same chemicals have been measured. In sum, the Air Committee study was designed to identify aspects of air quality where prevention efforts would be most effective in contributing to improving the future health of the community. This information must be combined with a much broader effort to

address all the factors contributing to community illness to effectively address community health concerns.

7. What were the results of the evaluation?

Of the 175 chemicals analyzed in the effort, only four exceeded the Committee Screening Values. Concentrations of benzene, 1,3-butadiene, carbon tetrachloride, and methyl chloride measured at the monitoring station were found to exceed the Committee screening values. The benzene level in Wagner's Point modeled from the emissions from area industries and other facilities was also above the Committee screening value. All other measured concentrations and concentrations modeled in Partnership neighborhoods were found to be below the Committee screening values. Except for the benzene level in Wagner's Point, the emissions from all the industries and other facilities in and around the Partnership neighborhoods resulted in modeled concentrations that were below the committee screening values. Vehicles and other mobile sources are a significant source for benzene and 1,3-butadiene. Carbon tetrachloride is primarily due to past uses (ToxFAQs,Sept.1995); methyl chloride concentrations are primarily due to past uses and natural sources (OAQPS,,Dec.1994). Additional details on the sources and other information on each of the four chemicals found to be above committee screening levels are given below:

As explained in Question 5 above, the Air Committee chose a screening value that corresponds to an increased cancer risk of one in one million under the assumed conditions of exposure. The total risk level for the four chemicals found to be above the Air Committee screening value correspond to an increased cancer risk of 6 in one hundred thousand. While this risk estimation is not a characterization of actual health risks, it can provide a relative indication of the potential health concerns associated with these chemicals. EPA programs use a risk management range of one in one million to one in ten thousand under their reasonable maximum exposure scenarios to guide their decision-making for carcinogens.

Benzene: The Committee determined that most of the benzene in outdoor air originates from cars and other mobile sources. Other sources of benzene in Partnership neighborhoods include a chemical plant in Fairfield, petroleum product terminals, and gas stations. Except for the Wagner's Point neighborhood, the modeled benzene concentrations from the industrial and commercial facilities were below committee screening levels. In Wagner's Point, mobile sources and bulk petroleum facilities account for most of the benzene. Benzene exposure can cause a distinct form of leukemia, known as acute myelogenous leukemia, and is classified by the EPA as a known human carcinogen (Group A). For more details on the health effects of benzene, see the attached fact sheet (ToxFAQs, Apr.1993).

1,3-Butadiene: In the Baltimore area, this chemical is emitted almost entirely by cars and other mobile sources. At the time of the analysis, 1,3-butadiene is classified as a probable human carcinogen by the U.S. EPA (Group B2; data in humans exist but are considered inadequate alone; data from rat and mouse studies are sufficient to indicate a carcinogenic potential in humans). For more details on the health effects of 1,3-butadiene, see the attached fact sheet (ToxFAQs, Sept.1995).

Carbon Tetrachloride: Monitored levels at Fairfield are due almost entirely to past emissions of this chemical which is now being phased out of use due to its effects on the earth's stratospheric ozone layer. Levels found at Fairfield are typical of urban areas where it has been measured. Long term exposure to carbon tetrachloride can produce liver and kidney damage. Carbon tetrachloride has been classified by the EPA as a probable human carcinogen (Group B2; data in humans exist but are considered inadequate alone; data from rat, mouse and hamster studies are sufficient to indicate a carcinogenic potential in humans) For more details on the health effects of carbon tetrachloride, see the attached fact sheet (ToxFAQs, Sept.1995).

Methyl Chloride: Also known as chloromethane, monitored levels in Fairfield are primarily the result of natural processes in the environment. Methyl chloride is present in air all over the world. Levels at Fairfield are similar to levels in other U.S. cities where air monitoring for methyl chloride has occurred. Long-term exposure to methyl chloride may produce liver, kidney, spleen and brain damage. Methyl chloride has been classified by the EPA as a possible human carcinogen (Group C), but has not been associated with any particular form of cancer in humans. For more details on the health effects of methyl chloride, see the attached fact sheet (OAQPS,Dec. 1994).

8. How does outdoor air quality in Partnership neighborhoods compare with other Baltimore locations and with other urban communities?

Benzene, 1,3-butadiene, carbon tetrachloride and methyl chloride are regional air pollutants and have been measured by MDE at six monitoring locations within the Baltimore region. The bar charts in Figures 1 through 4 on page 8 compare the concentration levels for each of the chemicals at the six monitoring locations. The Air Committee screening levels for the chemicals are also shown on the bar charts. Data from these locations are intended for use in an overall characterization of these chemicals in the broader Baltimore area rather than to support detailed assessment of specific neighborhoods. Interpretation of data from individual sites is complicated by differences in meteorological conditions that can affect readings as well as by siting that may have been chosen to complement other monitoring sites.

As illustrated in these bar charts, levels of 1,3-butadiene measured at Fairfield are the second lowest of the six locations. The levels of benzene, carbon tetrachloride, and methyl chloride measured at Fairfield are higher than those measured at the other locations. Given the small difference in the concentration levels measured at the different monitoring stations and given the uncertainties in the risk calculations, the risk levels associated with the measured concentrations at the six monitoring stations are too close to differentiate. In other words, the risks of the four chemicals may be essentially the same throughout the Baltimore area.

The committee also compared the level of these chemicals to levels in other cities where similar measurements were made. Measured levels in these cities are similar to Baltimore levels. Levels of carbon tetrachloride and methyl chloride in Baltimore were below the levels estimated for cities in the Agency for Toxic Substances and Disease Registry fact sheets for these chemicals. See Table 1 on page 9 for details of these comparisons.

9. Is air pollution in Partnership neighborhoods getting better or worse?

Emission and monitoring reports reviewed by the Committee demonstrate that air quality in Partnership neighborhoods and the surrounding region has been improving for several years (Maryland Department of Environment 1992-1996; USEPA, Dec. 10, 1996). This improvement is true for dozens of toxic chemicals as well as for common air pollutants for which there are national ambient standards. Information reviewed included emission reports submitted to the state and to EPA and air monitoring reports prepared by the state.

10. What can we do if we want to improve our air quality?

There are several ways that community members can work to improve air quality. First, the Partnership Air Committee would like to continue its work to learn more about the other parts of our air that are not included in this report. One of the Committee recommendations listed below calls for more work on odors, truck exhaust and truck routing. Volunteers are needed to work on these areas. Also, it is possible to address the emissions of the four chemicals identified in this report. Since most of these emissions are associated with mobile sources, that means getting involved in the national debate on controlling vehicle emissions. EPA is now working on these issues and community input will be crucial to the decisions made. The Partnership Air Committee plans to invite representatives from EPA and MDE to speak to the committee and then the committee will develop a plan to make the community's voice heard on these issues. The Committee also recommends further work with the local companies that are contributing to the levels of benzene in our air and to help them find ways to further reduce their emissions. Committee volunteers are needed to work on this as well.

11. What are the limits of the analysis used?

The committee utilized a conservative (i.e. one that is designed to overestimate concentrations and risks) screening method to reach these results. The resulting risk calculations do not correspond to actual exposure scenarios nor do they represent estimates of risk to actual persons. The analysis simply provides a systematic approach and a common standard to compare the relative importance of the measured or modeled chemical concentrations.

It is important to point out key limitations of the study that are due in part to the current state of the science used. 1) The study addresses only cancer risks to a hypothetical adult population resulting from inhalation exposure to specific individual chemicals. The study does not address other routes of exposure or possible toxicologic interactions among the multiple chemicals to which people are exposed. 2) The study does not specifically address sensitive segments of the population such as children. 3) The screening values used by the Committee were based on cancer effects. Because of incomplete information on the potential toxic effects of some chemicals, there may be other health effects, such as birth defects and endocrine disruption, that could lead to lower screening levels. Significant scientific uncertainty and controversy exists around the issue of very low dose effects for endpoints like endocrine disruption. Please see section 6 for additional explanation of the limits of the study.

12. What does the air quality committee recommend?

The Committee believes that the community should encourage the continual reduction of emissions, especially through pollution prevention measures. In addition, the Committee has proposed four recommendations. Community volunteers are needed to work on these recommendations.

1) Work with local facilities to reduce benzene emissions especially through more pollution prevention

2) Encourage appropriate actions to reduce odors. See attached page with results of the Committee Odor Survey listing known sources of odors in community

3) Encourage appropriate action to reduce diesel truck exhaust through means such as the enforcement of current truck traffic restrictions, better diesel motor maintenance for vehicles regularly using local roads, and the rerouting of truck traffic. See attached page with listing of diesel vehicles regularly using Partnership streets.

4) Develop ways to educate the community about the impacts of indoor air pollution

13. What else is being done to improve air quality?

On the local level, additional monitoring and air sampling work to get more accurate information on exposures is now underway. These measurements should add more information to the community's understanding of local air quality. The Partnership should continue to review data from MDE and any other local agencies with pertinent air quality information.

On the national level, EPA has proposed an ambitious new schedule for addressing risks from air toxics in urban areas that would, among other things, set new standards for dozens of categories of small, stationary sources not targeted under the agency's existing air toxics program. Under the strategy,"area" sources, such as institutional and commercial boilers, municipal landfills, paint stripping operations, and sewage treatment works, would face new requirements for cutting air toxics by 2009, with some rules taking effect as early as 2005 (USEPA,1999). The plan also calls on the agency to assess emission reductions from mobile sources and determine whether additional regulations are needed to cut air emissions from these sources. The agency is working to finalize these rules.

REFERENCES:

Maryland Department of Environment. Ambient Air Monitoring Data for 41 Chemicals from 1992 through 1996.

OAQPS. December 1994. Office of Air Quality Planning and Standards. USEPA. Methyl Chloride (Chloromethane). 74-87-3. Part II.

ToxFAQs. April 1993. Benzene. Agency for Toxic Substances and Disease Registry , U.S. Dept. of Health and Human Services, Public Health Service, Division of Toxicology, Atlanta, GA., 30333.

ToxFAQs. September 1995. 1,3-Butadiene. Agency for Toxic Substances and Disease Registry , U.S. Dept. of Health and Human Services, Public Health Service, Division of Toxicology, Atlanta, GA., 30333.

ToxFAQs. September 1995. Carbon Tetrachloride. Agency for Toxic Substances and Disease Registry , U.S. Dept. of Health and Human Services, Public Health Service, Division of Toxicology, Atlanta, GA., 30333.

USEPA. July 19, 1999. National Air Toxics Program: The Integrated Urban Strategy; Federal Register Volume 64, No. 137,

USEPA, OPPT. Dec. 10, 1996. TRI Indicators Report prepared by Steve Hassur: "Preliminary Analysis for the Baltimore Community Environmental Partnership Air Working Group

1996 Annual Average vs Screening Levels for Priority Chemicals

Figure 1. 1,3-Butadiene Monitored Concentration VS Screening Level Concentration

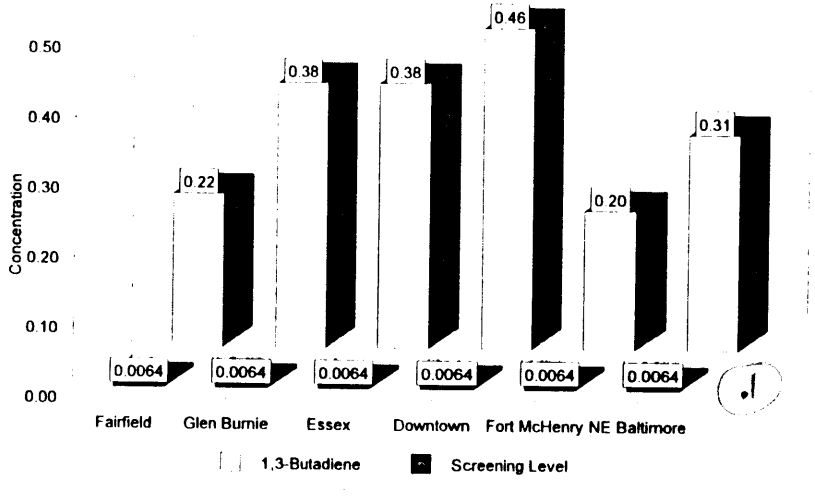


Figure 2. Benzene Monitored Concentration VS Screening Level Concentration

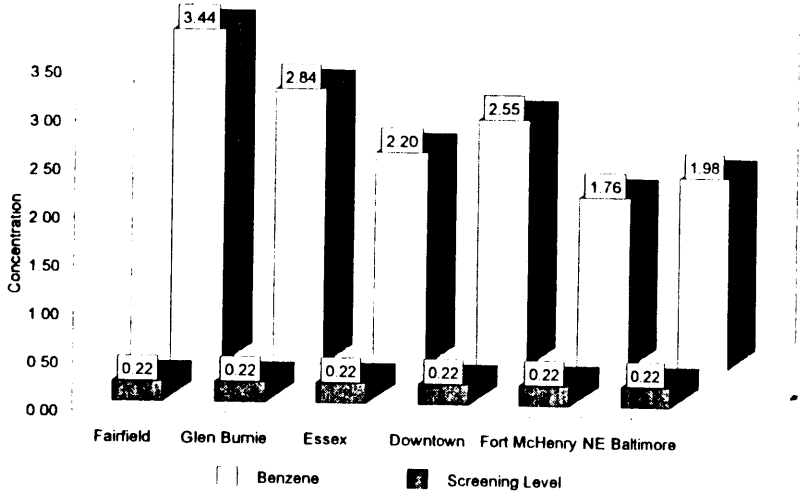


Figure 3. Carbon Tetrachloride Monitored Concentration VS Screening Level Concentration

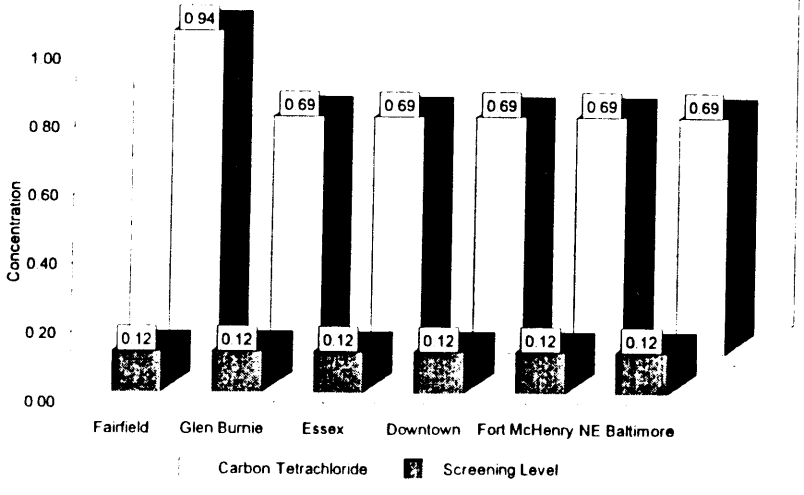


Figure 4. Methyl Chloride Monitored Concentration VS Screening Level Concentration

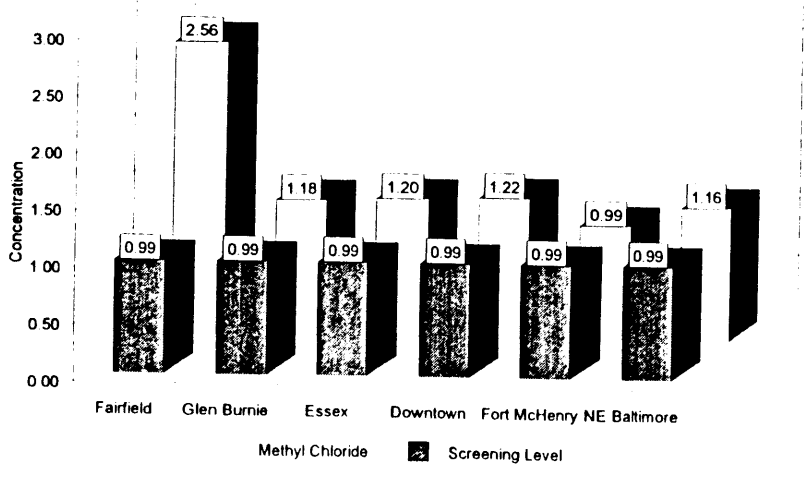


TABLE J-1
AVAILABLE MONITORING DATA
Annual Average Concentrations in ug/m^3

	Baltimore	Fremont, CA	Fresno, CA	Los Angeles	ATSDR	Louisiana	NYAir Toxics	Texas Air Toxics
Benzene	3.4	4.1	4.5	7.3	NA	3.8	2.67	1.9
Carbon Tetrachloride	0.94	0.48	0.49	0.50	0.63 background 1.3 - 3.8 in cities	1.0	1.1	0.57
1,3 Butadiene	0.22	0.34	0.43	1.04	NA	NA	NA	0.91
Methyl Chloride	2.5	NA	NA	NA	2.1 background 6.2 in cities	1.31	NA	NA

APPENDIX K

Baltimore Air Dispersion Modeling

Baltimore CEP Short Term Air Modeling- Summary of Model Set-up and Assumptions Used.

The Industrial Source Complex Short Term (ISCST3) model was run for five different scenarios. The manner in which the model was set up and the assumptions used were similar for each scenario. In general the changes between scenarios were limited to differences in the number of sources modeled, the type of pollutants modeled, pollutant emission rates, and modeling averaging times. Discussed first below, is the basic model setup and assumptions used common to all five scenarios. This is followed by individual discussions of the unique aspects for each of the five scenarios.

Model Setup and Assumptions Used (All Scenarios)

Both toxic and criteria air pollutants were modeled over five separate years (1987,1988,1990,1991,1992) or a subset of those years. All facilities were located in the southeast portion of the Baltimore Metropolitan area. Receptors locations were the same for all scenarios.

The following lists the model configuration/set-up used.

- Urban dispersion mode
- Flat, simple terrain
- No wet or dry plume depletion and no wet scavenging
- Regulatory default options used
- Assumed sea-level for all source base elevation heights
- Assumed sea-level for all receptors elevations (model assumes all receptors on flat terrain).
- No source grouping
- Calculate average concentrations only, no deposition
- Four discrete receptors*
- Fine cartesian grid with 250m grid spacing (700 receptors)**
- Coarse cartesian grid with 2000m grid spacing (72 receptors)**
- Hourly emission rate assumed to be annual rate divided by 8760 hours per year
- Assume no flagpole receptor heights
- No building downwash
- Surface weather data from Baltimore-Washington International
- Upper air weather data from Sterling VA.

* Location of discrete receptors (decimal deg.)

	Latitude	Longitude
Cherry Hill.....	39.2484	76.6237
Brooklyn.....	39.2332	76.6040
Wagners Point.....	39.2303	76.5689
Curtis Bay.....	39.2250	76.5903

** Corners for coarse grid (deg min sec)

Latitude	Longitude
39 17 27.3	76 39 20.5
39 17 36.2	76 28 12.9
39 09 53.3	76 39 09.9
39 10 02.2	76 28 03.4

** Corners for fine grid (deg min sec)

Latitude	Longitude
39 15 09.2	76 37 50.1
39 15 12.7	76 33 39.8
39 11 30.3	76 37 45.0
39 11 33.8	76 33 35.0

Note: The layout of the grid is depicted (with sources locations) in Figure 1 in Source Data Summary and Assumptions.

Source Data Summary and Assumptions

Twenty nine pollutants were modeled, from a total of 36 sources. Table K-1 lists all sources and their location. Note, as will be discussed later, pollutants modeled differed by source and by each of the five scenarios.

Table K-1. List of Sources Modeled and their Location

Source Name	Latitude	Longitude
Amerada Hess	39.209800	76.584898
Amoco Oil Co.	39.211600	76.584394
Amoco Station (Patapsco Ave)	39.238700	76.611800
Amoco Station (Ritchie Hyw)	39.219800	76.614700
Baltimore Resco	39.270803	76.630401
BGE- Brandon Shores	39.189101	76.534601
BGE- Wagner Station	39.178500	76.527401
TOSCO (Bayway Terminal) (BP)	39.229996	76.572702
Bethlehem Steel	39.219000	76.476594
Chemetals Corp.	39.194901	76.564601
CONDEA-Vista Chem.	39.235796	76.578195
FMC Agricultural Chemical	39.231695	76.581602
Grace Davison	39.209298	76.569402
Hobelmann Port Services	39.238796	76.571600
J.S. Lee's Body Shop, Inc.	39.217502	76.642904
Valley Proteins	39.214600	76.588500
Delta Chemical	39.230600	76.566700
Crown Station (Ritchie Hyw)	39.217400	76.614400
Crown Station (Potee St)	39.239400	76.611200
Baltimore City Composting	39.205700	76.560100
Brooklyn Service Center	39.234800	76.597600
Citgo Station	39.216800	76.615200
Shell Station	39.218400	76.614700
U.S. Coast Guard	39.204000	76.569700
MOTIVA (Mobil Oil) (Maritank)	39.235503	76.577899
Med Net/MedX Inc.	39.208804	76.569994
Norris Farm Landfill	39.288102	76.481500
Phoenix Services	39.202197	76.557398
Pori International	39.289599	76.507399
Quebecor Printing	39.171003	76.632399
SCM Chem.- Millennium	39.206098	76.545903
MOTIVA (Shell Oil Terminal)	39.233803	76.567701
CITCO (Star Enterprises)	39.230001	76.568995
Stratus Petroleum	39.241303	76.576094
U.S. Gypsum	39.204002	76.561201

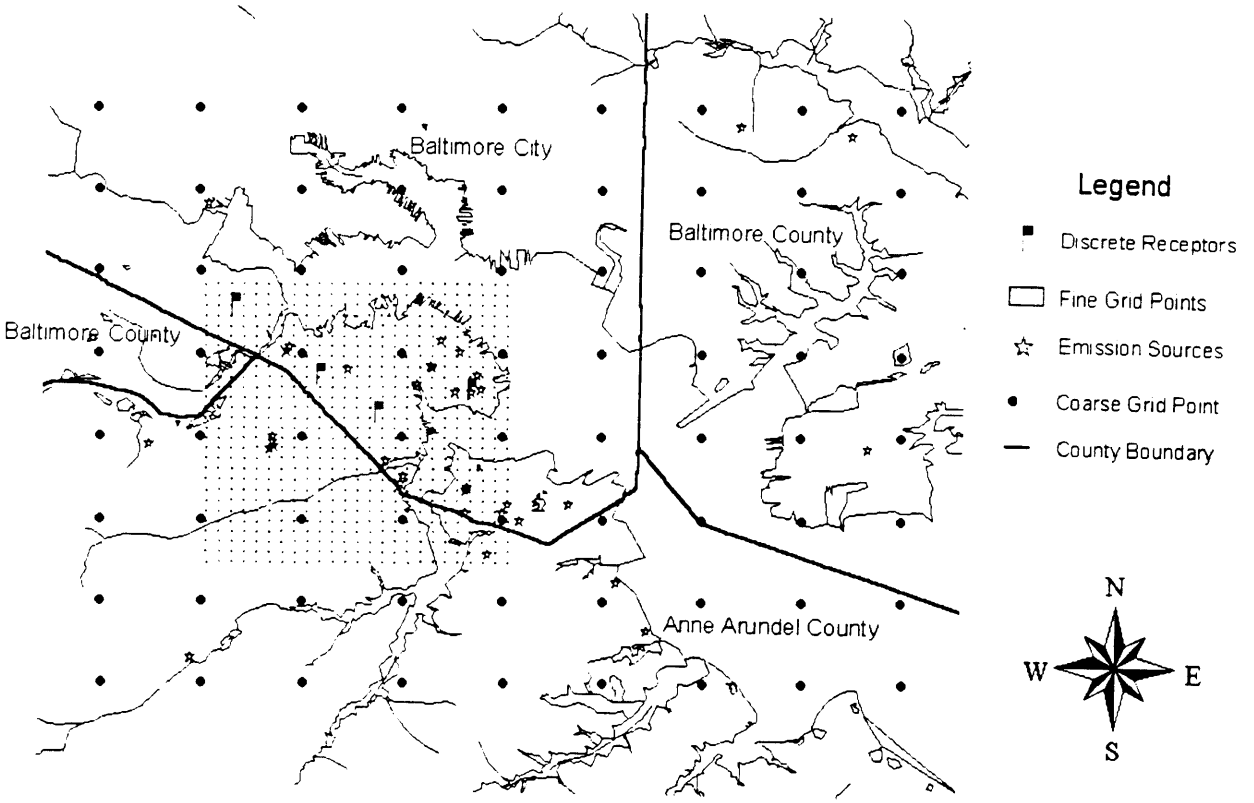
The location of all sources listed and receptors are shown in Figure 1. For many of the sources there was limited information available about the characteristics/nature of the air emission release. As a result a number of assumptions were used. The following briefly outlines any key characteristics of each source and briefly describes how each souse was modeled, included any assumptions used.

- **Amoco Oil:** Twenty identical stacks and one fugitive source. All pollutants modeled out of one stack.
- **Baltimore City Composting:** Stack parameters given for a composting reactor, and area source parameters given for a composting area. There was no breakdown of emissions between these two sources. Characteristics of the composting reactor stack (low exit velocity, low stack height, ambient air exit temperature and large stack diameter) seem to indicate that the stack may actually be a ceiling exhaust fan(s). Assumed all emissions from the composting area, with a release height of 3 meters.
- **Baltimore Resco:** Straightforward to model. One stack- all pollutants modeled out of this stack..
- **Bethlehem Steel:** Complicated source- several stacks and fugitive sources listed. For several pollutants no information was provided on the breakdown of emissions between the fugitive sources and the stack sources. For modeling purposes assumed all emissions to be from the BOF scrubber stack.
- **BGE Brandon Shores:** Source consists of two identical boilers and two similar stacks. Modeled all pollutants out of one stack.
- **BGE Wagner:** Source consists of four utility boilers and four separate stacks. Three stacks are similar, one stack has a significantly higher exhaust temperature. Pollutants were modeled out of one stack which best represented the three similar stacks.
- **TOSCO (BP Terminal) (Bayway Terminal):** One stack and five fugitive sources. Modeled as a point source.
- **Brooklyn Service Center (Patapsco Citgo):** No stacks, modeled as an area source.
- **Chemetals Corp:** 15 identical stacks- modeled out of one stack.
- **Citgo Station:** No stacks- modeled as an area source.
- **CONDEA Vista Chemical Company:** Boiler and process line emissions indicated. Assumed all pollutants except NO2 and SO2 are emitted from the process line only. Thus both the process line and boiler stack data provided were used to model the source.
- **FMC Agricultural:** Hazardous waste incinerator- modeled as a point source.
- **Grace Davison:** One stack- modeled as a point source.
- **Hobleman Port Services:** One stack- modeled as a point source.
- **J.S. Lee's Body Shop:** One stack- modeled as a point source.
- **Med Net/Medx Inc:** Medical waste incinerator (one stack)- modeled as a point source
- **Mobile Oil Co. Terminal (Maritank):** Five stacks, and area source- modeled as a grouped point source.
- **Norris Farm Landfill:** Modeled as a point source since there is a stack based venting system.
- **Phoenix Services Inc.:** Incinerator (one stack)- modeled as a point source.
- **Pori International:** One stack- modeled as a point source.
- **Quebecor Printing:** Two sets of stack parameter are listed, one for solvent recovery stacks and one for ceiling fans. Temperatures are similar for each set, velocity is higher for the fans than for the stacks. This source was modeled using the solvent recovery stack only, since increased buoyancy due to higher temperature in the recovery stacks will make up for the lower velocity of the ceiling fans. This source only operates during a 4-5 mo. block each year thus, hourly emission rates used were adjusted to reflect the shorter operating period.

- **SCM Chemicals (Millennium):** Information available for only one stack- all pollutants modeled as a point through a single stack, including boiler emissions.
- **MOTIVA (Shell Oil Terminal):** One stack (no area source information)- modeled as a point source.
- **Shell Station:** Modeled as an area source.
- **U.S. Coast Guard:** No stack information, assumed toluene emissions from an area source. Estimated the size of the area source as the typical dimensions of a Coast Guard vessel (assumed painting of a ship in dry dock). For NO2 emissions used stack parameters used to represent the boiler at Valley Proteins.
- **U.S. Gypsum:** One stack- modeled as a point source.
- **Amerada Hess:** Stack listed appears to represent emissions from fuel/oil storage and loading only (stack exit temp. was 77 deg. F). This stack was used to model benzene emissions. For NO2 emissions stack parameters from Amoco Oil were used as they better represent a flare (combustion process).
- **CITCO (Star Enterprises(& Stratus Petroleum:** No stack/release parameters given. Modeled both as a point sources using average of stack parameters from other terminals (Maritank), MOTIVA, Bayway and Shell Oil).
- **Amoco & Crown Stations:** No stack/release parameters given. Modeled as an area sources using the average of area source parameters given for the Shell Station, Citgo Station and the Brooklyn Service Center.
- **Valley Proteins:** Six stacks listed, 4 boiler stacks and two for a cooker. Assumed all emissions (NO2) from boiler stacks. Modeled NO2 out of one stack, which represented the average of the four stacks listed. Characteristics of the four stacks were similar, thus an average was used.
- **Delta Chemical:** No stack information provided for SO2 emissions. Modeled as a point source using stack parameters from US Gypsum.

Tables showing the stack and area source parameters used for the modeling effort are given in the Appendix.

Figure 1. Model Setup- Location of Sources and Receptors



Scenario One (Sept 97)

Twenty eight pollutants were modeled from a total of 22 facilities. The averaging periods used were annual and 24 hours. Table K-2a, shown below lists by facility the pollutants modeled and the corresponding annual emission rates used.

Table K-2a. Baltimore Facilities and Pollutants Modeled- Scenario One

Facility Name	Pollutant Name	Emission Rate (lb/yr)
Amoco Oil Co.	Toluene	9.746
	Benzene	4.000
Baltimore City Composting	Ammonia	206.660
	Benzene	7.156*
	Carbon tetrachloride	2.820
	Toluene	8.436
	Vinyl chloride	5.720
Baltimore Resco	Arsenic	630
	Cadmium	703
	Chromium	3.333
	Formaldehyde	4.355
	Hydrogen chloride	6.126.000
	Hydrogen fluoride	77.651
	Mercury	15.837
Bethlehem Steel	Cadmium	551
	Chromium	848
	Lead	958
	Manganese	20.124
BGE- Brandon Shores	Carbon monoxide	2.114.980
	Nitrogen oxides	45.987.400
	Sulfur oxides	93.865.380
	Arsenic	1.443
	Cadmium	178
	Chromium	909
	Lead	1.468
	Mercury	290
	Nickel	978
	Hydrogen Chloride	4.200.000
	Hydrogen Fluoride	5.200.000
	Dioxins and Furans	0.0062
BGE- Wagner Station	Carbon monoxide	816.140
	Nitrogen oxides	27.567.540
	Sulfur oxides	35.993.240
	Arsenic	462
	Cadmium	64

Facility Name	Pollutant Name	Emission Rate (lb/yr)
BGE- Wagner Station (cont.)	Chromium	294
	Lead	477
	Mercury	91
	Nickel	2,167
	Hydrogen Chloride	1,300,000
	Hydrogen Fluoride	160,000
	Dioxins and Furans	0.0019
TOSCO (Bayway Terminal((BP))	Benzene	1,120
Brooklyn Service Station	Toluene	141
Chemetals Corp.	Ammonia	59,568
	Hydrochloric acid	23,172
	Manganese	61,661
	Sulfuric acid	3,621
Citgo Station	Benzene	122
	Toluene	186
CONDEA-Vista Chem.	Benzene	3,000
	Hydrochloric acid	21,000
FMC Agricultural Chemical	Carbon tetrachloride	1,787
	Chloromethane	4,678
	Hydrochloric acid	707,808
	Toluene	15,628
Grace Davison	Ammonia	290,000
	Chromium	122
	Molybdenum trioxide	1,180
	Nitrogen oxides (NOx)	237,780
	Sulfuric acid	3,000
Hobelmann Port Ser.	Stoddard solvent	30,380
J.S. Lee's Body Shop, Inc.	Toluene	263
Med Net/MedX Inc.	Dioxins & Furans	0.00000199
	Hydrochloric acid	42,300
MOTIVA (Mobil Oil) (Maritank)	Benzene	882
	Toluene	5,291
Norris Farm Landfill	1,2-Dichloropropane	2,365
	Benzene	1,051
	Methyl chloride	2,365
	Methylene chloride	11,388
	Vinyl chloride	2,628
Phoenix Services	Dioxins & Furans	0.00282
	Hydrochloric acid	91,016
Pori International	Hydrogen sulfide	2,640
Quebecor Printing	Toluene	3,250,000
SCM Chem.- Millennium	Carbon monoxide (CO)	19,028,940
	Carbonyl sulfide	1,562,400

Facility Name	Pollutant Name	Emission Rate (lb/yr)
Millennium (cont.)	Sulfur oxides (SOx)	2,306,640
	Sulfuric acid	39,900
MOTIVA (Shell Oil Terminal)	Benzene	1,400
	Xylenes (m-,o-,p-)	1,500
Shell Station	Benzene	130
	Toluene	199
U.S. Coast Guard	Toluene	8,054
U.S. Gypsun	Chromium	26.2

* This number was determined to be erroneous. However, the emissions did not impact the Partnership neighborhoods.

Scenario Two (Oct 97)

Four pollutants were modeled from a total of twelve facilities. The averaging periods used were annual, 24 hours and 8 hours. Table K-2b, shown below lists by facility the pollutants modeled and the corresponding annual emission rates used.

Table K-2b. Baltimore Facilities and Pollutants Modeled- Scenario Two

Facility Name	Pollutant Name	Emission Rate (lb/yr)
Baltimore Resco	Chromium	70
	Hydrogen chloride	6,126,000
Bethlehem Steel	Chromium	848
	Manganese	20,124
BGE- Brandon Shores	Chromium	909
	Hydrogen Chloride	4,200,000
BGE- Wagner Station	Chromium	294
	Hydrogen Chloride	1,300,000
Chemetals Corp.	Hydrochloric acid	8,901
	Manganese	16,707
CONDEA-Vista Chem	Hydrochloric acid	12,000
FMC Agricultural Chemical	Hydrochloric acid	2,600
	Methyl chloride	150
Grace Davison	Chromium	122
Med Net/MedX Inc.	Hydrochloric acid	6,250
Norris Farm Landfill	Methyl chloride	130
Phoenix Services	Hydrochloric acid	6,952
U.S. Gypsum	Chromium	26.2

Scenario Three (Jan 98)

Three pollutants (benzene and speciated chromium - Cr+3 and Cr+6) were modeled from a total of twenty two facilities. The averaging periods used were annual, 24 hours and 8 hours. Table K-2c, shown below lists by facility the pollutants modeled and the corresponding annual emission rates used.

Table K-2c. Baltimore Facilities and Pollutants Modeled- Scenario Three

Facility Name	Pollutant Name	Emission Rate (lb/yr)
Amoco Oil Co.	Benzene	80
Baltimore City Composting	Benzene	7,156*
Baltimore Resco	Cr+3	67
	Cr+6	3
Bethlehem Steel	Cr+3	847.152
	Cr+6	0.848
BGE- Brandon Shores	Cr+3	633
	Cr+6	276
BGE- Wagner Station	Cr+3	204
	Cr+6	90
US Gypsum	Cr+3	25.999974
	Cr+6	2.6e-5
Grace Davison	Cr+3	122
TOSCO (Bayway Terminal) (BP)	Benzene	220
Citgo Station	Benzene	61
CONDEA-Vista Chem.	Benzene	2.200
Amoco Station (Ritchie Hwy)	Benzene	67
Amoco Station (Patapsco Ave)	Benzene	66
Crown Station (Ritchie Hwy)	Benzene	62
Crown Station (Potee St)	Benzene	44
MOTIVA (Mobil Oil) (Maritank)	Benzene	1,440
Norris Farm Landfill	Benzene	16
Star Enterprises	Benzene	348
Stratus Petroleum	Benzene	880
MOTIVA (Shell Oil Terminal	Benzene	480
Shell Station	Benzene	65
Amerada Hess	Benzene	652

* This number was determined to be erroneous. However, the emissions did not impact the Partnership neighborhoods.

Scenario Four (Jan 98)

Benzene was modeled using the facilities and emission rates listed in Table K-2c. Each facility was modeled separately for 1990 and 1991 only. This was done to determine each facilities contribution to the average annual benzene concentration at Wagners Point in 1990 and at the receptor with the highest overall concentration in 1991. Note, the 1990 average annual benzene concentration at Wagners Point and the 1991 highest receptor concentration were the highest overall values calculated for all years modeled in Scenario 3.

APPENDIX L

Peer Review Comments and Response

Peer Review Comments and Response

This appendix presents the results of the peer review of the November 5, 1999, draft of *Air Committee Technical Report - Risk-Based Air Screening: A Case Study in Baltimore, MD* (the Baltimore Case Study report). The materials presented summarize the main issues raised by the six peer reviewers and the subsequent activities initiated by EPA and the Baltimore Air Committee to respond to and revise the document. This appendix includes a brief overview of the scope and purpose of the peer review, the charge given to the peer reviewers, a list of the peer reviewers, copies of their complete comments, and the responses to comments. The comments and responses are organized into three major categories: (1) main issues raised in the peer review, (2) suggestions for improvements to the risk screening methodology that will be prioritized for future implementation, and (3) suggestions for clarifying the Case Study report.

Scope of Peer Review

The peer review of the draft document *Air Committee Technical Report - Risk-Based Air Screening: A Case Study in Baltimore, MD* was conducted to evaluate the technical procedures used in the risk screening process in Baltimore. Technical experts from the Federal government, academia, and industry were identified and asked to review the Case Study document and the methodology used. Although the review focused primarily on the risk screening steps that were developed in the course of the Baltimore study, the peer reviewers were also asked to evaluate the methodology (emissions inventory, initial screen, secondary screen, final screen) and the stakeholder participation process and provide comments on potential improvements. The charge to the peer reviewers is presented on page L-19.

Background

EPA requires that all major scientific and technical products developed for use in decision making undergo peer review. The policy applies to both internal and external products that support research, regulatory, or other Agency decisions. The *Peer Review Handbook* (U.S. EPA, 1998), published under the auspices of the Science Policy Council (SPC), provides Agency-wide guidance on the process for conducting peer reviews.

> *The goal of the Peer Review Policy and this Handbook is to enhance the quality and credibility of Agency decisions by ensuring that the scientific and technical work products underlying these decisions receive appropriate levels of peer review by independent scientific and technical experts.*
>
> *Peer review is intended to uncover any technical problems or unresolved issues in a preliminary (or draft) work product through the use of independent experts. This information is then used to revise that draft product so that the final work product will reflect sound technical information and analyses. Peer review is a process for enhancing a scientific or technical work product so that the decision or position taken by the Agency, based on that product, has a sound, credible basis* (U.S. EPA, 1998).

Selection of Peer Reviewers

Candidate experts were identified and selected to conduct the peer review on the basis of their expertise in the topic areas covered in the document (air quality assessment, emissions modeling, and risk screening/assessment, etc.). These experts were selected in a manner that ensured objectivity; the peer reviewers were independent and had no actual or perceived conflict of interests. Six experts, selected from a wide range of organizations including academia, consulting firms, industry, and government organizations, are listed below:

Michael A. Callahan
U.S. EPA National Center for Environmental Assessment

Gail Charnley, Ph.D.
HealthRisk Strategies

Douglas Crawford-Brown, Ph.D.
Department of Environmental Science and Engineering
University of North Carolina at Chapel Hill

Amy D. Kyle, Ph.D.
School of Public Health
University of California, Berkeley

Kenneth L. Mitchell, Ph.D.
U.S. EPA Region 4

Ronald E. Wyzga, Sc.D.
Electric Power Research Institute

Peer Review Comments

The full written comments from the six peer reviewers are attached at the end of this appendix.

Response and Reconciliation

The responses to the comments received on the Baltimore Case Study report are organized into three major categories: (1) main issues raised in the peer review, (2) suggestions for improvements to the risk screening methodology that will be prioritized for future implementation, and (3) suggestions for clarifying the Case Study report.

1. Main Issues Raised by the Peer Reviewers

In summarizing the peer review comments, EPA and the Baltimore Air Committee identified seven issues to address. These issues were selected because they raise important questions about the Baltimore air screening exercise and its conclusions. A statement of the seven issues and EPA's responses follow:

Issue 1.1 Two reviewers pointed out that confidence in the ability of the screening process to identify all chemicals of concern needs to be better demonstrated in the report. As pointed out by the reviewers, if the screening process is valid, the screening concentrations should decrease or remain the same as chemicals proceed through the screening. Each subsequent step in the screening process uses better information to more accurately characterize the concentrations. Reviewers suggested that the report should explicitly illustrate the decrease in the concentrations of the chemicals at each step to build confidence in the screening process. Conversely, if the use of better information results in higher concentrations, then the earlier steps of the screening process may not be designed to be sufficiently protective and the confidence in the screening may be misplaced. If the concentrations go up with the chemicals selected for review, then concentrations for chemicals eliminated might also be higher with better information. The concentrations may, in fact, go above the screening levels and consequently, the process may eliminate chemicals that may be of concern. Reviewers point out that, in fact, concentrations for one of the selected chemicals, benzene, increased in the final step of the process. This higher concentration needs to be explained or the validity of the process will be in question.

Response It is agreed that there is a need to better demonstrate the validity of the screening by demonstrating the decrease in concentrations as one advances to later stages of the methodology. While this is generally true, and could be shown with the examples of chromium, hydrochloric acid, and manganese, the increase in estimated benzene concentrations from the secondary to the final screen raises questions. The means by which the validity of the methodology will be demonstrated will be clarified in the "How To" manual.

The final screen for benzene resulted in the discovery of additional sources of emissions or increased annual benzene emissions over those used in the secondary screen in the Wagner's Point area near the modeled receptor location. These increases in emissions account for the increase in modeled airborne concentrations between the secondary and final screens. This reflects an error of omission in the construction of the emissions inventory that was discovered when a closer examination of the facilities emitting the chemical was conducted. Had the facilities and their correct annual emissions been identified in the initial inventory steps, no increases in benzene concentrations between secondary and final steps would have been observed.

The results for benzene were unusual, but not unexplainable . It is unlikely that an increase in exposure from secondary to final screen would be observed unless additional sources identified were in close upwind proximity to the receptor. In the case of benzene in Wagner's Point, this condition was met because the neighborhood is in close proximity to petrochemical storage facilities all emitting benzene. The updated information resulted in increased emissions and estimated concentrations.

The sources of other chemicals eliminated by the screening process were better known, not as numerous as benzene, and could be confidently eliminated from review. For example, the release of a "specialty" chemical, i.e., a chemical with a unique use, is only going to be found in association with the specific industrial process it is used in. If the facility employing that process is captured in the emissions inventory, it is unlikely that other emissions of the "specialty" chemical will go unaccounted for. On the other hand, a commodity chemical such as benzene could be used in and released from a multitude of processes, and because a larger number of facilities could potentially be releasing the chemical, there is a greater possibility that emissions could be missed due to an incomplete inventory.

We will suggest in the How To manual that in future screening exercises it will be important for chemicals like benzene with multiple sources to pay special attention to the source inventory and to keep chemicals with widespread sources in the process until all the sources are properly characterized. The comment and the experience with benzene point to the importance of building an accurate source inventory. The confidence in the screening process depends on this accuracy.

Issue 1.2 Two reviewers raised concerns that routes other than inhalation may produce important different results for the chemicals considered. They state that ingestion can be a significant contributor to risk for many products of combustion processes, e.g., for mercury and dioxin. Concerns were raised that the cumulative assessment could easily show that some chemicals excluded at the lower screens should have been carried forward into the higher screens if this route of exposure had been considered.

Response The focus of this investigation, as designed by the community, was on local industrial, commercial, and waste treatment and disposal sources. It was the judgement of the Air Committee that the most significant exposure pathway for these local sources was inhalation. Several peer reviewers commented that non-inhalation exposure pathways such as fish and beef ingestion can be significant for some of the chemicals studied. We agree, but it was the judgement of the Air Committee that the contribution of the local sources to these non-inhalation pathways was not significant and, as a result, they were not included in the study. A more comprehensive picture of community risk would certainly include these pathways. The OPPT Community Assistance Technical Team recognizes that developing a more comprehensive understanding of risk is an important issue for communities. In its goal to develop the most comprehensive screening tools possible, the team plans to make the ingestion pathway a priority item for improving and expanding the Baltimore screening methodology.

Issue 1.3 The report should have a formal variability and uncertainty analysis.

Response EPA agrees that variability and uncertainty analyses would strengthen the overall risk screening results, but such an analysis was beyond the scope of this screening-level assessment. For future community assessments, Internet citations of available uncertainty analysis methodologies will be included and can be incorporated if resources permit.

Issue 1.4 The analysis does not address the project's goal because it does not look at aggregate risk from multiple chemicals.

Response EPA agrees with the comments that the Baltimore report does not look at the aggregate risk of all the chemicals and that analysis of aggregate risk information is of value to the community.

Because of the importance of this issue, the effort to find an effective way to estimate aggregate risk will be made a priority for future work. The Baltimore project did provide information on aggregate risk for the four chemicals that were identified in the final screen. The Air Committee report, found in Appendix J, states that the total risk level for the four chemicals found to be above the Air Committee screening value corresponds to an increased risk of 6 in 100,000.

To see if any additional review of the data might provide important information for the community, EPA reviewed the information developed by the Baltimore Air Committee and estimated the aggregate cancer risk for the 12 chemical carcinogens analyzed in the secondary screening step. Aggregate concentrations for these 12 chemicals were measured and/or estimated with air dispersion modeling for the second step of the screening process. Since the Turner calculation used in the initial screen did not calculate aggregate concentrations, it was not possible to estimate, using this approach, the aggregate risk for the chemicals in the initial step of the screening process.

The individual and aggregate risks for 12 carcinogens analyzed in the secondary screen, as they were calculated in the Baltimore screening exercise, are included in the table below. The last column provides the best estimate for the total aggregate risk from the 12 chemicals. The second column displays the estimated risk for the four chemicals that were identified as community priorities in the final step of the screening process. As displayed in the table, the addition of all the chemicals adds a risk of about 3 in 1,000,000 to the aggregate risk of 6 in 100,000 for the chemicals identified in the final screen. Please note that the risk estimates for the chemicals at the secondary screening level are based on maximum permitted emission rates and not on the best available information used in the final step of the screening process. Please see a fuller description of the limits of these risk screening estimations in the Air Committee Report, Appendix J.

Aggregate Cancer Risk Estimates

Pollutant Name	Risk Based on Modeled Conc.	Risk Based on Monitored Conc.	Best Estimate
Arsenic	3.55E-007	0.00E+000	3.55E-007
Benzene	1.75E-006	1.44E-005	1.44E-005
Butadiene, 1,3-	0.00E+000	3.60E-005	3.60E-005
Cadmium	1.48E-007	0.00E+000	1.48E-007
Carbon tetrachloride	1.70E-007	7.40E-006	7.40E-006
Chloromethane (Methyl chloride)	1.85E-008	1.17E-006	1.17E-006
Chromium +6	6.02E-008	0.00E+000	6.02E-008
Chromium +3	0.00E+000	0.00E+000	0.00E+000
Dichloropropane, 1,2-	3.00E-009	0.00E+000	3.00E-009
Methylene chloride	3.57E-010	0.00E+000	3.57E-010
Dioxins & furans (2,3,7,8-TCDD)	2.68E-008	0.00E+000	2.68E-008
Formaldehyde	5.95E-009	0.00E+000	5.95E-009
Vinyl chloride (Chloroethene)	2.64E-007	0.00E+000	2.64E-007
Aggregate Risks	**2.80E-006**	**5.90E-005**	**5.98E-005**

Issue 1.5 Reviewers make the point that the toxicity information for many chemicals is inadequate and that the toxicity information for the protection of children and infants from the effects of toxic substances is particularly inadequate. Given these inadequacies, reviewers state that it is not responsible to represent the toxicity database as sufficiently complete to allow for full assessment of the likely health significance of hazardous air pollutants, and assessments based on the current toxicity database should be represented as a likely underestimate.

Comment Toxicity data for more than 115 of the 175 chemicals were available from the two main sources used for this assessment, EPA's Integrated Risk Information System (IRIS) and Health Effects Assessment Tables (HEAST). IRIS was chosen as the primary source of toxicity information because of its availability and because of the level of scientific review of the assessments contained in IRIS. IRIS is widely recognized by the scientific community as a preferred source of chronic toxicity data for environmental risk assessments. In the absence of toxicity data for a chemical from IRIS, the secondary source for data used in the assessment was HEAST. Toxicity data available included 28 chemicals with cancer slope factors and 93 with RfDs with 57 of the 93 based on the inhalation pathway. Because of the available data, many, but not all, of the chemicals in the Baltimore inventory could be assessed as part of the screening process. A more complete literature search for toxicity data was beyond the scope of the Baltimore screening-level assessment.

EPA agrees with the reviewers' comment that the toxicity information available for the Baltimore screening was not comprehensive. The information did allow the community to address known chronic hazard concerns. EPA also agrees that the limits of the analysis resulting from the incomplete toxicity data should be made clear. Language further stressing this point has been added to the Case Study.

For future screening-level community assessments, efforts will be made to identify additional sources of toxicity information readily available to communities via the Internet or other means. An effort will also be made to make new toxicity information from expanded testing initiatives, such as the High Production Volume Challenge Program, available to communities.

Issue 1.6 Reviewers raised concerns that because measured and modeled airborne concentrations of the same chemical were different, the modeling was not accurate, and that results using estimated airborne concentrations are of questionable value. It was also suggested that monitoring must be done to verify the modeling.

Response Several reviewers raised questions about the validity of the air dispersion modeling used in the Baltimore project. While we agree with the reviewers on the need for adequate monitoring to support air dispersion modeling, we believe that modeling can provide important and valid information. In the Baltimore project, limited resources did not allow for additional monitoring. Air dispersion modeling was used to estimate concentrations in the absence of measured values obtained from monitoring. Air dispersion models are the primary tools used to simulate the chemical and physical processes in the atmosphere that affect the movement of pollutants from the source to the receptor (Turner, 1994). Such models are the most widely used techniques for estimating the impact of pollutants from point sources (U.S. EPA, 1987). Air dispersion models have been tested and validated and are widely used by EPA and State government organizations for risk assessment, regulatory, and permitting purposes. The modeling methods used are

generally considered to be applicable for assessing impacts of a source from the facility fence line out to a 50 km radius of the source being modeled (U.S. EPA, 1992).

Such models can provide information to help target air monitoring. Models can also predict the average concentrations of any released pollutants at any given location. Air monitors, on the other hand, can only measure pollutants that occur at that particular monitor. Air dispersion models can provide information concerning the concentration a pollutant is likely to reach. Air monitors can only measure the concentration on the day the monitor collects a sample Most importantly, air dispersion models provide information needed for risk management (for example, indicate what facility released a particular pollutant in unacceptable amounts).

In addition to general questions on the value of air dispersion modeling, several reviewers noted the discrepancy between the concentrations measured at the monitoring station located in the target area and the modeled concentrations. In several cases the measured concentrations are much higher than modeled concentrations. This led reviewers to question the accuracy of the modeling overall. The issue of the difference between the measured and modeled concentrations is discussed on page 53 of the Case Study report and illustrated for benzene in the pie chart in Figure 5 on page 55. We do not believe that the differences question the validity of the air dispersion modeling. The modeling did not include mobile sources and the Air Committee concluded that the difference between monitored and modeled concentrations could largely be explained by the contribution of mobile sources to the monitored measurements. As noted in the text, the modeling of mobile sources is strongly recommended for future air screening exercises. Although geographical areas cannot be directly compared, the recently released report summarizing a study of air quality in Southern California, the MATES-II Report, generally confirms the Air Committee conclusion on the contribution of mobile sources to the measured concentrations. In this report mobile sources are estimated to account for at least 90 percent of benzene emissions. (Draft MATES II Report of the South Coast Air Quality Management District, Reference study, November 1999. Available at http://www.aqmd.gov/news1/MATES_II_results.htm).

Turner, D. 1994. Workbook of atmospheric dispersion estimates: an introduction to dispersion modeling. Second edition. CRC Press, Inc. Boca Raton, FL.

U.S. EPA, 1987. Guideline on Air Quality Models (Revised). U.S. EPA Office of Air Quality Planning and Standards, Research Triangle Park, NC. EPA-450/2-78-027R.

U.S. EPA, 1992. A Tiered Modeling Approach for Assessing the Risks Due to Sources of Hazardous Air Pollutants. U.S. EPA Office of Air Quality Planning and Standards, Research Triangle Park, NC. EPA-450/4-92-001. March 1992.

Issue 1.7 With respect to cumulative target organ analysis, the section on grouping chemicals according to "similar organs or physiological systems" needs to be reconsidered because only respiratory and neurological effects were evaluated.

Response EPA agrees with the comment that the attempt to identify chemicals with cumulative effects did not follow the procedures for a hazard index calculation. The Baltimore risk screening exercise was only a limited attempt to identify chemicals acting on the same target organs, which might potentially have cumulative effects. Neither a hazard index or cumulative risk assessment was attempted. Hazard index and cumulative risk assessment require information on the mechanism of toxicity so that chemicals with the same or a similar mechanism can be grouped and the

impact of their toxicities summed. The information necessary for such an assessment was not available for this screening level assessment. The need to provide guidance on identifying chemicals with cumulative effects is included on the list of improvements for future work.

2. Suggestions for Improvements to the Risk Screening Methodology That Will be Prioritized for Future Implementation

The following comments raised issues that call for future improvements in the risk screening methodology. These comments are organized by the steps in the risk screening process and are presented in tabular form.

Suggestions for Future Improvements
SCOPING ISSUES:
Use facilitator in Partnership interaction activities (meetings, decisions, etc.)
Limit inclusion of indoor air
Look at multiple pathways of exposure
PARTNERSHIP (STEP 1):
Get agreement up front for a risk management plan
EMISSIONS INVENTORY (STEP 2)
Broaden beyond industrial, commercial, waste, especially to mobile (maybe use ASPEN) Include wastesites and landfills in source inventory
INITIAL SCREEN (STEP 3)
Improve access to toxicity data
Use recent California effort to derive acute toxicity values
Consider sensitive population analysis
Add cumulative/aggregate inhalation exposures to screening
INITIAL SCREEN (STEP 3) (continued)
Identify in advance a process for addressing issues in toxicity
Suggested method for accounting for aggregate at initial screen
Use consistent, conservative screening values throughout all screening steps (e.g., the Region 3 RBC values).
SECONDARY SCREEN (STEP 4)
Place one of the grid receptors on a school, hospital, nursing home or other sensitive population
FINAL SCREEN (STEP 5)
Expand monitoring as most important conclusion
Conduct air monitoring to validate air dispersion modeling predictions
Discuss detection limits for monitoring information used in screening
Consider persistence of chemicals in environment
Consider using 24 hour, 70 year exposure for urban populations to ambient air

3. Suggestions for Clarifying the Case Study Report

The following comments generally called for clarification in the Case Study report. In most cases the comments were determined by EPA to warrant attention and the document was revised to add the clarification needed.

Suggestion 3.1. Additional discussion is needed to explain the way the terms RfD and RfC are used in the document.

Response EPA added text on page 32 to help clarify how toxicity data were used in the initial screen. For the noncancer assessments, RfC values were converted to RfD values based on EPA-approved procedures. EPA scientists preferred to use an estimated dose and the associated RfD because risk assessors needed to evaluate risks for many types of scenarios. RfCs incorporate exposure assumptions and can only be used for one exposure scenario. By using the RfD, the same estimated doses (based on inhalation exposures) could also be used in the cancer risk calculation by combining it with the cancer slope factor. As a result, RfCs were converted to RfDs and inhalation doses were calculated for the scenario being assessed (see Region 3 RBC table in Appendix D). Conversion of RfCs to the more traditional RfDs is straightforward using a 20 m^3/day inhalation rate and a 70 kg body weight.

Suggestion 3.2 Clarification is needed on the types of air pollution sources that were included in the emissions inventory used as the basis for the risk screening. Clarification should be added to address confusion over point sources and area sources.

Response The emissions inventory for the Baltimore Case Study focused on industrial, commercial, and waste treatment and disposal sources of air pollution, ranging from small sources such as gas stations with annual emissions to air of less than 100 pounds of chemicals, to large facilities with annual emissions of over 1 million pounds. Many of these are known as point sources, such as power plants, steel mills, chemicals plants, and other large facilities. Mobile sources of air pollution, such as vehicles and small engines were not covered in the inventory. The table below (also presented on page 19 of the revised report) provides a summary of the types of sources included (and not included) in the inventory for the Baltimore Case Study.

It is also worth clarifying the use of the term "area source," which is used in two different contexts in the report. Area sources are smaller stationary sources of pollution that are not inventoried individually but whose emissions are estimated as a group and reported as a single source category for a geographic area. Examples of area sources include gas stations and dry cleaners. Another somewhat different use of the term area source applies to air dispersion modeling when the emission from a source could not be associated with an exact emission point, such as an exhaust stack. The emissions from these sources were modeled as though they were uniformly emitted from the entire area covered by the site. Within the description of the air modeling procedure, these are referred to as area sources. Care should be taken not to confuse the use of area source in the context of air dispersion modeling with the definition of area source used in defining the size of sources.

Source Inventory Table

CAA Category	Included in Baltimore Inventory	Not Included in Baltimore Inventory
Point (major stationary) Examples: chemical plants, power plants, incinerators, landfills, steel mills, POTWs	X	
Area (small stationary) a) Commercial and industrial chemical use and handling Examples: dry cleaners, gasoline stations, print shops	X	
b) Commercial, industrial, and institutional boilers Examples: school, hospital, office building heating		X
c) Household heating and chemical use Examples: furnaces, fireplaces, lawn chemicals		X
Mobile Sources a) On road Examples: cars, trucks, buses		X
b) Off road Examples: portable generators, construction equipment, boats, lawn mowers		X

Suggestion 3.3 Explain that some carcinogens have thresholds.

Response The text has been revised to more accurately represent the threshold/nonthreshold characteristic of chemical toxicity. A change to the document was made in the text box that appears on page 26 that adds: "But there are exceptions. For example, some carcinogens have thresholds."

Suggestion 3.4 Provide clarification on Figure 5 and the discrepancy between the modeled and the monitored concentrations of benzene in the Partnership area.

Response EPA has revised the report to provide additional discussion of the contribution of inventoried emission sources to the benzene concentrations monitored at the Fairfield station. The annual emissions from individual benzene sources are contained in the ISCST3 input file. Initially all benzene emissions were included in the modeling run and the maximum annual average concentration in the approximate geographic center of each neighborhood was calculated. To determine the contribution of each individual benzene

source to the total ambient air concentration in the neighborhoods, the model was run repeatedly with only one benzene source "turned on" at a time. This yielded an estimated maximum airborne concentration due to the single emissions source under consideration. That value was compared to the estimated concentration due to all sources to determine the contribution of that source (percentage of the total). Using this same approach, emission sources could be grouped together, if desired, as when many small sources are being considered.

The Partnership had both monitored and estimated annual average concentrations for benzene in one of the Partnership neighborhoods (Fairfield). A comparison of the two values was performed to determine how closely the predicted concentration matched the monitored concentration. The monitoring station in Fairfield is about ½ mile from the location of the highest predicted concentration of benzene in Wagners Point. At this distance the two locations could be unequally subject to influences, such as nearby benzene sources or differences in wind direction and frequency, that could confound the comparison of benzene concentrations. Nonetheless, if it is assumed that the modeling is accurate, then significant differences between measured benzene concentrations and modeled benzene concentrations could be due to sources of benzene not captured in the emissions inventory. The unaccounted-for emissions could be due to unregistered stationary sources or, more likely, benzene emitted from mobile sources (cars and trucks) passing through the area on high-volume routes such as I-695 and Patapsco Ave and at the I-895 toll plaza. It is well known that mobile sources make a significant contribution to benzene concentrations in urban air.

Suggestion 3.5 Clarification is needed on the methodology used for selection of the receptor locations for the ISCST3 modeling, including the geographical area considered for modeling and the receptor grids.

Response The Partnership area was defined by neighborhoods (Cherry Hill, Brooklyn/Brooklyn Park, Curtis Bay, Wagners Point) and by ZIP Codes 21225 and 21226. The coordinates of the neighborhoods corresponded with their approximate geographic centers of these towns. Page 43 of the report provides additional details on the receptor grids and the four Partnership neighborhoods used as the primary receptor locations. Recognizing that air pollutants may be transported from outside the Partnership area, facilities within 5 miles of the Partnership area were included in the emissions inventory. While this approach did not capture pollution transported from other regions of the United States, it represents an exhaustive attempt to consider local commercial and industrial stationary sources.

Suggestion 3.6 One commenter suggested that EPA should create a summary table for the 29 chemicals showing the concentrations and screening values used in each step.

Response It was determined that such a table would be very complicated and would not help the reader to interpret the outcome of the initial screen. EPA did not make the suggested change to the report because similar tables were included in Appendix I for the secondary screen, which involved fewer chemicals.

Suggestion 3.7 The document needs clarification on the sources available for toxicity data because the gaps could hinder the assessment of a chemical's human health effects.

Response The document was revised to inform the reader of the availability of toxicity data for the chemicals emitted in the Partnership area. Toxicity data for more than 115 of the 175 chemicals were available from the two main sources used for this assessment, EPA's Integrated Risk Information System (IRIS) and Health Effects Assessment Summary Tables (HEAST). These were the best readily available sources of toxicity information for this assessment. Specifically, changes on pages 28 through 30 were made to better describe the sources of toxicity data considered for the screening process. Toxicity data available included 28 chemicals with cancer slope factors and 93 that had RfDs, of which 57 were based on the inhalation pathway. This meant that many, but not all, chemicals could be assessed as part of the screening process.

IRIS was chosen as the primary source of toxicity information because of its availability and because of the level of scientific review of the assessments contained in IRIS. In the absence of toxicity data for a chemical from IRIS, the secondary source for data used in the assessment was HEAST. These are widely recognized by the scientific community as the preferred sources of toxicity data for environmental risk assessments. It is acknowledged that these sources are not comprehensive, but they do allow the community to address known hazard concerns. A more complete literature search for toxicity data was beyond the scope of this screening level assessment. The best readily available sources will also be recommended for future screening level community assessments, but efforts will be made to identify additional sources of toxicity information readily available to communities via the Internet or other means.

Suggestion 3.8 Clarification is needed on the initial screening approach and how it addresses only one source at a time.

Response The initial screen addressed emissions from individual sources because it used the Turner equation to estimate resulting air concentrations and exposures. Only in subsequent steps, where ISCST3 modeling was used, could estimates be provided for air concentrations of chemicals emitted from multiple sources.

Suggestion 3.9 The "professional judgment" that was applied for screening is not well documented and needs clarification.

Response EPA revised the document to clarify the discussion of the chemicals identified from the initial screen and the subsequent elimination of select chemicals based on professional judgment. We added text after the table on page 34 that says: Chemicals with an "*" were not selected for the next stage of the screening process because they were no longer emitted from the facility because of changes in the production process or the facility that had emitted them was no longer in operation.

Suggestion 3.10 Additional clarification is needed on the conservative nature of toxicity data, which often have many safety factors built in.

Response The document was revised on page 28 to better explain the toxicity data used in the screening and the potential for overestimating risks. For example, EPA slope factors express carcinogenic potency in terms of the estimated upper-bound incremental lifetime risk per milligram per kilogram (mg/kg) average daily dose. Cancer slope factors (CSFs) are available, where applicable, for either oral (SF_o) or inhalation (SF_i) exposures. Unit

risk is a similar measure of cancer potency for air or drinking water concentrations and is expressed as risk per microgram per cubic meter ($\mu g/m^3$) in air or as risk per microgram per liter ($\mu g/L$) in water for continuous lifetime exposures. The term upper bound in this context means that the measures of cancer potency are high-end estimates, so they will be conservative. This may result in an overestimate of cancer risk when toxicity data are incomplete, which is usually the case. Uncertainty and modifying factors are a few included in deriving the toxicity values, which makes the resulting toxicity values (e.g., RfDs, RfC, etc. more conservative. Upper-bound values are intended to be protective of human health for continuous lifetime exposures, even though cancer risks may be overestimated. The use of the average or lower limit values would be more likely to underestimate cancer risk.

Suggestion 3.11 Clarify the use of term "actual risk" in the report.

Response No changes were made to the document in response to this comment. In this context, use of "actual" was intended to inform the reader of the uncertain nature of risk assessments such as this, so it was important to note that these estimates could not be considered to be the "actual" risks.

Suggestion 3.12 The definition of a reference dose should be expanded to make it clearer.

Response EPA agrees with the comment and the clarification was added to the report. Specifically, the following text is now included on page 28:

A measure of toxicologic potency for chronic (long-term) effects is the "reference dose" or "reference concentration." The reference dose (RfD) is defined as "an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without appreciable risk of deleterious effects during a lifetime" and is expressed as a mg/kg-day dose (U.S. EPA, 1997e). The reference concentration (RfC) is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily inhalation exposure of the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious noncancer effects during a lifetime. Conversion of RfCs to the more traditional RfDs is straightforward using a 20 m^3/day inhalation rate and a 70 kg body weight. RfD values for inhalation were derived from RfCs and are used in this study. The RfD is usually based on the most sensitive known effect (i.e., the effect that occurs at the lowest dose) and can exist for both oral exposures (RfD_o) or for continuous inhalation exposures (RfD_i).

Suggestion 3.13 The example source inventory database table should be modified. It carries too many significant figures for a risk assessment and the last two columns on risk and HQ should have two significant digits.

Response The purpose of this table was to provide an illustration of the database that was used for managing the data used in the screening process for the Baltimore Case Study. It is not desirable to change it in the report because the same change would have to be made in the database as well. Also, EPA recognizes that the number of significant figures is limited and that their presentation could imply a level of precision in the estimates that does not exist. For example, the aggregate risk estimates presented earlier were 5.98 per 100,000,

but EPA rounded that to 6 per 100,000 because we recognized the uncertainty in such estimates. Therefore, EPA will not change the report or database at this time, but will make the issue of the appropriate number of significant digits a future improvement issue for the database.

Suggestion 3.14 The report should be clarified to indicate that non carcinogenic screening values were also used in the risk screening.

Response EPA's risk screening methodology included both cancer and non-cancer effects (as reflected on page 29) by selecting screening levels that correspond to both types of endpoints. For the initial screen, the risk screening values of 10^{-6} for cancer and HQ > 1 for other chronic effects were used to screen individual sources. The secondary and final screens used the Region 3 RBCs as the basis for the screening levels. The RBCs are developed by EPA Region 3 scientists to reflect the concentrations at which either the cancer risk to an exposed population is 1 in a 1,000,000 or the HQ is 1. Therefore, all phases of the screening considered cancer and noncancer endpoints.

Suggestion 3.15 Incorporate the Air Committee Report into the Case Study.

Response The Air Committee Report has been revised and is presented as an appendix to the Baltimore Case Study report. EPA chose not to combine the two reports. The Air Committee Report was prepared by the Partnership and has very specific wording that was developed through a consensus-building process. EPA chose to present that report in its entirety as an appendix to the Baltimore Case Study report.

Suggestion 3.16 Add more detail, including citations, to make the document clearer and more transparent including information from the literature on similar risk screening methodologies.

Response EPA agrees and has added to the report many more citations for data and approaches used by other studies that we considered in developing the methodology. The intent is to provide the reader with information on the sources of information, particularly Internet Web sites, that were accessed to obtain information. Also, the "How to" methodology document that is being developed can be considered to be a companion piece to this report. That document will add more specifics on the types of data sources available for use in studies such as these.

Suggestion 3.17 Clarify which monitoring data were used in the screening.

Response EPA added information on page 22 about the monitoring data available for the Partnership area. 1996 annual average concentration data (the most current year available) from the Fairfield monitoring station were generally used in the screening. The use of maximum values would have probably been too conservative since they were not typical of air quality and would not have been representative of the concentrations of chemicals in the air that the neighborhood residents breathe. Data were available from 1992 to 1996 for the 41 chemicals monitored from the five Baltimore area monitoring stations (Glen Burnie, Downtown Baltimore, Fort McHenry, Essex, and Northeast Baltimore) and the one station located in the Partnership area. These data from the Fairfield monitoring station were used in the screening to represent concentrations in the Partnership area. Table I-1 in

Appendix I summarizes the monitored concentrations that were used in the screening process.

Suggestion 3.18 Clarification is needed to indicate that the predicted concentration at a grid receptor is the sum total for a chemical from all modeled sources.

Response EPA agrees and has made this clarification in the text (page 41) to reflect that the ISCST3 modeling performed in the secondary and final screens considered multiple sources that release a chemical.

Suggestion 3.19 Clarification is needed on the inhalation rate used in the calculations in the initial screen.

Response The 1 m^3/hr inhalation rate is a part of the overall Turner methodology as described in Appendix E. This is contrasted against the 20m^3/day inhalation rate used in the conversion of unit risks to cancer slope factors. The 1m^3/hr rate used in the Turner calculation is the standard method that EPA/OPPT used for previous assessments. Revising this methodology is beyond the scope of the Baltimore Case Study. This is an issue for EPA/OPPT to consider in general, and for the technical team to consider in improving the air screening methodology. For instance, the inhalation rate might be slightly revised because EPA's *Exposure Factors Handbook* reports 13.8 m^3/day as the median breathing rate, which could be used for both the Turner methodology and the unit risk factors.

Suggestion 3.20 Clarification is needed on Table 4 which indicates "NA" for a number of secondary screen emission rates while these same chemicals have values for final screen emission rates.

Response The final screen for benzene resulted in the discovery of additional emissions sources that were not part of the secondary screen. Therefore, Table 4 reflects the increased annual benzene emissions over those used in the secondary screen in the Wagners Point area near the modeled receptor location. These increases in emissions account for the increased modeled airborne concentrations of benzene in the final screen.

Suggestion 3.21 For the Fairfield monitor, the document should state whether it is a source-oriented monitor or a community-based monitor. This same comment holds for the other Baltimore area monitors mentioned in Appendix J.

Response The Fairfield monitor, as well as other toxic air pollutant monitors in the Baltimore area, are positioned so as to provide readings suitable for estimating exposure over a larger geographic area. This text change was included on page 22 of the Case Study report.

Suggestion 3.22 Appendix G should be revised for accuracy. Extraneous information that is not used in the screening process should be removed.

Response EPA reviewed the list of columns detailed in Appendix G of the Baltimore Case Study report and made them consistent with the example spreadsheet. We agree with the comment that extraneous information (i.e., not used in the screening process) should be removed. For the version of the spreadsheet that is included in the Baltimore Case Study report, some of the columns have been deleted. Similarly, the spreadsheet used to manage data for future assessments is being revised as part of the "How to" manual. We hope that

these changes will make the spreadsheet more manageable and applicable to all stages of the screening.

Suggestion 3.23 Appendix J should be enhanced to more fully describe the Clean Air Act requirements to address air toxics in urban air, including a more thorough discussion of MACT standards, the residual risk program, cleaner fuels, etc.

Response EPA did not make any changes in response to this comment because the issues are beyond the scope of this screening effort.

Suggestion 3.24 Appendix K discusses the use of 5 years of modeled data for the screening. Clarification is needed on the multiple modeling scenarios.

Response Appendix K provided background information on model set-up, assumptions and a chronology of modeling runs with ISCST3. Modeling scenario 1 in Appendix K is the modeling for the secondary screen. Scenario 2 represents an intermediate step that included more accurate information on emissions. Scenario 3 incorporated additional information on the type of chromium emitted by facilities and added updated benzene emissions. Scenario 4 was used to determine the contribution of individual facilities' benzene emissions to the total modeled benzene concentration in Wagners Point. Both toxic and criteria air pollutants were modeled using local meteorological data from the most current years available (1987-1988, 1990-1992). Generally, it is recommended that meteorological data over a five year span be used in air dispersion modeling to account for temporal variations. The highest predicted values either for the receptor locations (1 of 4) or for any given year (1 of 5) were typically used to make the screening as conservative as possible.

Suggestion 3.25 Provide clarification on the rationale for the selection of the discrete neighborhood receptors (e.g., Cherry Hill at a given lat/long)?

Response The document was revised on page 43 to describe the receptor locations. The Partnership area was defined by neighborhoods (Cherry Hill, Brooklyn/Brooklyn Park, Curtis Bay, Wagners Point) and by ZIP Codes (21225, 21226). The coordinates of the neighborhoods corresponded with their approximate geographic centers, which were used in the ISCST3 modeling to estimate ambient air pollutant concentrations for those four communities.

Suggestion 3.26 The document should include a fuller description of the airsheds and meteorology of the area.

Response No changes were made to the document in response to this comment. EPA feels that this issue is addressed sufficiently in the modeling methodology. Both toxic and criteria air pollutants were modeled using local meteorological data from the most current years available (1987-1988, 1990-1992). Generally, it is recommended that meteorological data over a 5-year span be used in air dispersion modeling to account for temporal variations.

Instructions/Charge

to ERG for

Peer Review of

Baltimore Screening Methodology

Instructions/Charge to ERG for Peer Review of Baltimore Screening Methodology

I. General Instructions

A. Conflict of Interest:

The Reviewer(s) shall not be a resident of the geographic area which is the subject of the report or the reviewer shall not be currently involved or have previously participated in technical support work affiliated with this document. In addition, the reviewers should not be affiliated with private organizations or stakeholders involved in this effort to the point that there may be a perceived conflict of interest.

B. Scope of Review:

The Case Study under review describes a risk-based air screening exercise carried out by the Air Committee of the Baltimore Community Environmental Partnership. The work of the Baltimore Air Committee consisted of the development of both a risk-based screening methodology for analysis of neighborhood air quality and also a partnership building process designed to increase participation and build the community's long-term ability to address air quality concerns. Peer reviewers are asked to provide feedback, as appropriate, on both of these aspects of the project. Questions on the risk-based screening methodology are given in General Charges 1 and 2 and in the Specific Charges. A question on the partnership building component is provided in General Charge 3.

As the work in Baltimore progressed, lessons learned and suggestions for improvements were identified and included in the case study. In Charge 2, peer reviewers are asked to comment on the improvements identified in the case study.

EPA would like the reviewers to focus on content issues related to the above. An editorial or quality control review is not requested.

II. Project Goals

The goals listed below were adopted by the Baltimore Air Committee as a guide to its work. Peer reviewers are asked to comment on the work of the Air Committee in light of these goals.

A. To determine if the current aggregate levels of toxics in the air in the Partnership neighborhoods resulting from the multiple industrial, commercial and waste facilities in and around the Partnership may adversely affect community health.

B. To recommend actions to improve air quality in the Partnership neighborhoods. (Recommendations to be based on the information on risk-based priorities provided by the screening exercise.)

C. To build the long-term capacity of the community, including residents and businesses, to take responsibility for their environment and economy.

III. Charges

A. General Charges

1. Did the screening methodology, as applied in Baltimore, achieve goals A and B?

2. The report identifies various technical improvements to the screening methodology. These are listed below. Could the methodology (emissions inventory, initial screen, secondary screen, final screen), as modified with the improvements identified below, help other communities seeking to understand and improve air quality? Please comment on both the appropriateness of the improvements listed below and their priority. Are there other improvements that should be considered?

   (a) Addition of mobile source modeling: The Baltimore exercise focused on stationary and area sources. This task will expand capacity of methodology to include mobile source modeling

   (b) Review and improvement of source inventory Review: Review existing source inventories to identify additional sources of emissions to insure that all significant sources are included

   (c) Identification of best source for toxicity data: Compare available toxicity data bases to identify most accessible and complete source of data for community screening exercise

   (d) Expand Baltimore methodology to include short term acute effects

(e) Review screening calculations to determine if they are appropriate for and protective of sensitive and urban populations

(f) Development of a method to screen for cumulative exposures in the Initial Screening Step

(g) Expand methodology to include indoor air risks to provide a more comprehensive picture of air risks

(h) Incorporation of GIS mapping to enhance the communication of the modeling and screening results

3. Are the partnership and community participation aspects of the screening exercise described in the case study and in the lessons learned section appropriate to achieve goal C? Could this screening exercise be used in other geographic areas to reach this goal. Can you identify any improvements or changes in the screening exercise that would help accomplish this goal?

B. Specific Charges: Please provide us feedback on the following aspects of the methodology, given project goals A and B:

1. The Emissions Inventory: Were the inventory of sources and the release and monitoring data used in the Baltimore screening exercise sufficient and appropriate to reach the goals of the committee? What additional sources do you think should be included in a source inventory to expand the scope of the methodology for use in other communities?

2. The initial screen: a) Were the methods for calculating airborne concentrations, potential dose, and risk appropriate and scientifically justified?; b) Was the screening criteria that was applied to identify chemicals for further analysis appropriate?

3. The secondary screen and the final screen: a) Was the modeling approach for developing estimates of neighborhood concentrations from multiple sources technically sound?; b) Was the screening criteria that was applied appropriate?; c) Were the assumptions built into the Region III risk-based concentrations appropriate.

4. Does the draft Committee Report (found in the appendix) adequately and accurately describe the screening exercise and its results?

5. Is the screening methodology as used in Baltimore sufficiently protective of sensitive populations? What would you suggest, if anything, for improving this aspect of the screening methodology?

Peer Review Comments

Michael A. Callahan

U.S. EPA National Center for Environmental Assessment

Peer Review Comments for

Baltimore Community Environmental Partnership Air Committee Technical Report

Michael Callahan

Senior Science Advisor - U.S. EPA, National Center for Environmental Assessment

A. **General charges:**

1. **Did the screening methodology, as applied in Baltimore, achieve Goals A & B?**

I think that at best, this project can only be termed a partial success in Goal A and a failure in Goal B. The methods for data collection worked well, analysis less well, getting consensus terribly, and the rest, particularly in dealing with the various agendas on the Committee, not well at all. Without all of the parts working well, this or any future project based on this methodology cannot be thought of as an overall success.

Hindsight can be valuable, especially if this methodology is to be applied to other cities and situations. One of the things I thought planted the seeds for the discontent realized later in the project was the stark contrasts between the questions the community had (pages 12-13), and the much narrower scope agreed upon for this project (bottom of page 13). I realize that many of the concerns of the community were not immediately answerable due to, among other things, lack of a workable methodology. On the other hand, even if the community agrees to the narrowed scope, and even if the project went off perfectly, there would still remain a feeling in the end that the community's questions were not answered. The paragraph on the top of page 56 talks about the need for the community to understand the limitations of this tool, but what about EPA's need to understand the questions the community is asking, and helping them get answers? If we have the "hammer" in this methodology, do we also have to see every question either as a nail or irrelevant?

If this methodology is to be applied to other communities, it is important that EPA find a way to at least address the other questions (which are very common ones communities ask), or *every* project will have a certain community dissatisfaction as a result. This is somewhat like "bait and switch," with the questions answered not being the questions asked. It may take the community a while to figure this out, but when they do, trust is lost, probably permanently.

It is not clear from the writeup (page 14) who exactly the "some Committee members" were that had the concerns about distracting the focus of the group from speaking "directly to the main community oncern," but in retrospect it seems a flawed decision. Apparently not everyone on the Committee understood the implications of only looking at air toxics emissions from facilities. It's not even clear that this was indeed "the main community concern," since concerns about air pollution also included odors and concerns about "midnight releases." Future applications of this methodology will have to take great pains to make sure everyone actually understands and agrees to what steps are to be taken, and the implications. There also should have been, again looking in retrospect, a contingency discussion. "What happens if we find no levels of chemicals above our health benchmarks? What happens if we can't document any permit violations? What if we **do** find something of concern? What are the next steps?"

In terms of general peer review question 1, Goal A was only partly successful on the surface. If viewed from the larger view of the community's concerns, it failed. A lot of data was collected and models run, but they only covered part of the picture (a significant part, nonetheless). The limitations of the data and methods did not allow the project to make a statement such as "the air levels of toxics are in a range EPA sees as safe, based upon conservative assumptions ($<10^{-6}$ cancer risk and <1.0 HI). Community concerns are directly focused on the safety of residents, and scientific temporizing is not satisfying to the community. Moreover, although data collection was successful, analysis and interpretation of results failed spectacularly. The last sentence on page 53, "A consensus on the interpretation of the results did not develop, and the effort was halted..." is a marvelous understatement. In looking forward to future applications of this methodology, we can also look forward to this type of disagreement unless specific ground rules and contingencies are built into the planned interpretation of the data. Questions like, "What if we find this? How will that be interpreted?" should (again, with hindsight) be discussed before any data are collected.

I think asking if Goal B was successful is a question that answers itself. If the Committee could not even agree on interpretation of the data, how could they recommend logical steps for the community to take other than generic ones? Only generic remedies would be quite unsatisfactory to the community after their expectations were raised by all the neighborhood data being collected, since they probably knew the generic steps beforehand (or at least the Committee could have listed them early on). Specifically, I can find no real recommendations in the "recommendations" section in pages 52-54. On benzene, recommendations were "postponed." For mobile source chemicals, the partnership was told to participate in nebulous "air quality improvements at the regional level," with discussion of what that means to be supplied later. For carbon tetrachloride and methylene chloride, "Recommendations were not developed...." As a batting average, this record is close to – if not exactly – .000.

2. **Various technical improvements in the methodology.... Are there other improvements that should be considered?**

There appears to be a serious imbalance between the technical methods used for data collection and analysis on one hand, and the development of the rest of the methodology (called Partnership and Community Participation in Goal C), including listening, interaction, teaching, negotiations, etc., on the other. This methodology simply *will not work* if the technical side is built up to the exclusion of the other side, as suggested by the list of bullets under this charge. Is the overall mission of this methodology project to build a new computer or GIS-based tool and release it to make the world a better place? Or is it to collect the tools and methods, and provide them, along with advice, to the communities to help them better analyze their situation and hopefully to better solve their own problems? I get the impression it is the latter, but the story reads like the former. Where are the questions about how to make the non-technical side better?

That being said, in my opinion, community assessment is a cumulative-risk-type operation. Anything that improves the ability to see, understand, interpret, and explain the "big picture" about what people are exposed to and where possible threats to health are coming from, is helpful. Mobile source monitoring would be helpful in the context that it can be linked to actual exposures and legitimate recommendations (which need to be thought about beforehand). As for toxicity data, there are no magic data banks that have the answers we have been seeking lo these many years. The usual ones, IRIS, HEAST, RBES tables, etc., are sufficient for now; they have to be, since there isn't much else out there. When new tox data become available, I'm sure it will be widely publicized within the toxicology, risk, and public health communities. Meanwhile, the methodology should note that before the methodology is applied at a new location, the currency of the tox data should be checked by someone who is knowledgeable about such things.

If acute effects are to be included in the methodology, a lot more work needs to be done on how the concentration values are to be obtained. Long term modeling for an area for chronic effects is one thing, but trying to evaluate acute effects possibly from a small pocket of air is quite another, and a modeling-only approach will probably not satisfy the community (there will be too many anecdotal incidents, for one thing). The issue of odors will have to be added to the acute effects analysis, also. The issue of acute effects will almost certainly require some on-site monitoring. All in all, it is a big, costly, addition to the methodology, but EPA may have to start moving in that direction if it wants to be relevant in answering the communities' environmental questions.

In terms of the screening methodology calculations, I do not believe EPA will be able to get away with saying "this is not a risk assessment" very much longer. The questions being asked by the communities (e.g., pages 12-13) have significant risk components, and to do calculations and say "this is not risk assessment" (and rightly so!) will eventually be viewed as avoiding answering the communities' questions and concerns. The technology exists now to estimate concentrations, develop exposure scenarios, etc. Within a short time, the ability to do multiple chemical modeling, at least on a screening level far better

than the Generic Turner Model, will be commonplace. EPA should aim its methodology at that. After all, we are no longer doing calculations on a piece of paper with an adding machine. This project took many years and there was ample opportunity to do fairly sophisticated technical analysis. We should start from that point, and analyze the chemicals that need to be analyzed, not reach back for tools like the GTM to get rid of things that might add to the cumulative risk.

Including indoor air methods may be the single best improvement to the methodology in terms of developing realistic and useful recommendations about how to improve the community's health. It is a mixed blessing, however, as many persons do not want anyone telling them anything about their own lifestyle or the way they keep their homes, which has a large influence on indoor air concentrations. It is invasive of one's lifestyle, expensive (NHEXAS=$17M), and often finds things that individuals would rather not see pointed out. But, *it gets results.* Adding indoor air methodology should not be taken on as an issue without eyes wide open as to cost and potential for highly charged discussions (case in point: the community representatives' leaving the Baltimore project was – according to their letter – due at least in part to their feeling that the analysis was moving in this direction, if only by suggestion of others on the Committee that lifestyle issues were important).

GIS mapping is a worthwhile addition to the methodology, and will probably be critical within a year. Communities will not have the capabilities to do their own GIS work in the short term, but perhaps within a few years the software will be available for tomorrow's PCs. Meanwhile, EPA should provide some help in running maps for the areas that use this methodology.

3. **Are the partnership and community participation aspects of the screening exercise in the case study and in the lessons learned section appropriate to achieve Goal C?...**

The lessons learned section is wonderful and right on the money. The improvement needs to be in the mind set which begins a case study like this. EPA can go into one of these with the approach of trying to help answer the community's questions, the sort of approach that's embodied by the statement, "I don't know the answer to that, but I'll find somebody that does, or find out what is known about that issue," and then follow through. Contrast that approach to one which says, "I have a tool here, but it can't answer all your questions. Let's see which ones it can shed light on or answer." The former is a real partner, while the latter is a helpful salesman. If partnership and community participation is a goal, it must be approached with the partnership attitude. A helpful salesman may be appreciated, but will never, and can never achieve the goal of being a full partner, with all the positive benefits that implies. A salesman, even a helpful one, will never quite be trusted completely.

B. **Specific Charges:**

1. **Emissions inventory.**

I was somewhat disappointed at the "winnowing down" methodology which modeled a collection of sources which represented 95% of the pounds of emissions. I think there should be a way to model all the sources that contribute. This will avoid questions about "what was left out of the analysis?" later. The smaller facilities won't add much, but the more complete analysis will be much more satisfying to the community. As far as emissions data, the sources will vary by state. TRI is universally suspect as to accuracy, but it's the best there is in many places. Most states have a database of facilities which includes smaller facilities not required to report to TRI (MDE had such a database here). At the very least, these two sources of data should be investigated in any case study. Local monitoring data and other local sources should be investigated on a case-by-case basis with help from the community and local government. As a footnote, *it is absolutely imperative that before modeling, the lat/long locations of the facilities be ground-checked.* TRI is notoriously bad for having inaccurate lat/long information, and a drive-around with a global positioning system (GPS) locator can save a lot of embarrassment later.

2. **Initial Screen.**

The Generic Turner Method essentially calculates an average concentration of a theoretical place 100 meters from a 3 meter high continuous release (essentially as a fugitive release at this height). If this is to be a bounding estimate (as it appears) to eliminate all the chemical-facility combinations that would not in themselves be problematic, the use of the 25% factor to lower the concentration at the 100 meter point by a factor of four seems to defeat the purpose. It would seem better to just assume the wind blows the same way all the time, and if the chemical-facility combination could not get above the benchmark criteria as a bounding estimate, then it would be eliminated from further consideration.

As for appropriateness of the criteria, I think that this will be a *very* conservative calculation, and should be labeled a bounding estimate. It will eliminate only those chemicals which should be quite a bit below the risk levels represented by the screening criteria, when more realistic exposure parameters are used.

I still feel that this step will eventually prove unnecessary and counterproductive, as discussed a few paragraphs above.

3. **Secondary and final screen.**

My opinion is that the several weeks of computer time needed to run ISC-LT3 was an unnecessary luxury for this screening exercise. The hourly and daily values calculated by the model (that chew up computer time like crazy) are just not needed. I suggest that either ISC-LT2 or some modification of ISC-LT3 that runs more efficiently be used. This would allow modeling of all the sources, rather than the methodology having artifacts like only modeling facilities which account for 95% of the load (which is a direct result of having a model that takes forever to run). I think the statement (end of 3rd paragraph, page 36) that, "Professional judgment was used to verify that omitted facilities would not affect the analysis"is silly. Either an analysis was done to *verify* that the omitted facilities didn't matter, or it was judgment, which of course doesn't *verify* anything. I think using ISC-LT3, in its current configuration, for this analysis is a big drawback. The additional accuracy of ISC-LT3 over ISC-LT2 may be more than eaten up by not having all the sources in the model. This could be checked fairly easily before this methodology is sent on to another case study.

The reason for the more restrictive criteria of the secondary and final screens (50% of the Region III criteria) was never explained satisfactorily, other than it was a group decision. This is another artifact of having a slow model, since with a faster model, you wouldn't have to exclude chemicals and would not find yourself explaining why you changed criteria - it would never come up.

The issue of screening with health-based values is a real problem here, and it is one that is not really taken head-on in the methodology. People in the community have health-based concerns and questions, EPA does an extremely conservative first screen, and yet EPA can say nothing about the relative safety of the air people are breathing? I know scientists are loathe to make such statements, but EPA's policy makers, if no one else, need to think about what can be said to the community, or EPA will forever be the (helpful) salesman and never the partner. Being "only" the salesman means that this methodology, no matter how many technical bells and whistles are grafted onto it, will ultimately fail to be embraced by communities. Having health-based criteria, and then punting at the end, is too confusing and looks like a hidden agenda to sweep potential problems under the rug to many in the community.

4. **Does the draft Committee Report adequately and accurately describe the screening exercise and its results?**

The draft Committee Report is quite well written and describes the project in some cases better than the full report. I have several comments on it. I like the sentence under #5, paragraph 2 that says, "A screening value is an air concentration that the Committee is confident does not pose a significant health risk." This is about as close as it gets to saying "a safe level." It would be helpful to note here that there were a couple of dozen other chemicals that were found or modeled that fell below this level. Later in the

same paragraph, it might be useful to point out (top of next page, sentence ending "...cannot be directly compared.") that the State standards may also be levels that do not pose a significant health risk, but the Committee chose its screening levels so that the committee could make the above definitive statement.

Under #10, it states that volunteers are needed, but doesn't say how one might volunteer or to whom. The first set of figures (Figs 1-4) have no units.

One unsettling aspect of the report is that it leaves one huge question unasked and unanswered. **Why did the modeling results show essentially no chemicals above the criteria, yet the monitoring data showed four of them?** Does this mean that for individual neighborhoods where models were run and nothing found, if monitoring data were taken there, toxic pollutants above the "safe" criteria levels would be found? This is an important question that goes directly to the credibility of the report with the public. Somebody out there **will** ask this question!

5. **Is the methodology sufficiently protective of sensitive populations?**

As far as I can tell, no effort was made to address this question at all in the study. It isn't the methodology that's "protective" anyway, it's the health-based screening criteria. The way the screening criteria were selected leads me to believe "the methodology" would allow any new committee for a new case study to select any criteria they wish (after all, that's how it was done here!). Without some limits, this question can't be answered.

If the question means, "Are the screening criteria as used here protective of sensitive populations?", that's a different question, but it still can't be answered without doing the homework necessary to come to a reasonable conclusion. This report shows no evidence of such homework, nor does it even get into much discussion about why the criteria values themselves were selected. Without some record of the logic used, I would have to conclude, "not necessarily."

Peer Review Comments

Gail Charnley, Ph.D.

HealthRisk Strategies

Comments on EPA's Baltimore Community Environmental Partnership

Air Committee Technical Report

Gail Charnley

19 November 1999

General Charges

1. Achieving goals A and B

The screening methodology, as applied in Baltimore, partially achieved goal A and has not yet achieved goal B. Goal B involves making recommendations to improve air quality in the study area, but that issue is not addressed in the technical report.

The screening methodology indicates that the contaminant sources evaluated do not exceed threshold risk values. Given the conservative (health-protective) nature of the assumptions underlying the methodology, the conclusion that those sources do not contribute to adverse health effects is likely to be correct. The results of the project were limited by its focus only on air toxics from point and area sources, however, which are fairly extensively regulated. Focusing on air toxics while ignoring important sources of the more prevalent criteria air pollutants yielded an incomplete picture. Thus it is possible that poor air quality does contribute to public health problems, but by failing to look at the whole picture, the study could not answer the question. The report readily admits that not evaluating mobile sources is a problem. As mobile sources appear to be major contributors to air pollution in the study area and in urban areas in general, it is important that future efforts attempt to include them.

2. Technical improvements

The list of needed improvements is excellent. I'm not sure that including indoor air risks in the methodology itself would be useful or practical, however. Comparing ambient air risks to some general estimates of indoor air risks might be more useful and practical. The only improvement I might add is to consider using a professional facilitator for future efforts. There is a growing literature suggesting that professional facilitation by someone who is experienced in community stakeholder-type efforts is fairly critical for success.

I think that the priority of the improvements matches the order in which they are listed.

3. Achieving goal C

The partnership aspect of the project was clearly troubled. To some extent, it seems that the partnership aspect was doomed from the start. By focusing on the question of what the risks are from air toxics, the project was based on the implicit assumption made by the community that air toxics play a role in their health problems. The community clearly started with an assumption that poor air quality in Baltimore poses an unacceptable risk to their health and when that assumption was not verified, withdrew from and condemned the project and its outcome. The project thus only partly achieved goal C. By not asking the question—What factors contribute to health problems in the community?—and then finding that air toxics do not contribute to health problems in the community—the project was left in the uncomfortable position of being unable to recommend solutions to the real problem. Building community capacity to take responsibility for their environment and their economy was thus only partly achieved. The contribution of air quality to public health problems should have been addressed within the framework of the larger question being addressed by the community health committee.

I believe that the screening method could be used in other communities to help understand the role that air toxics may or may not play in public health, but it should *not* be used by other communities unless it is part of a larger project looking at both other sources of air pollution and other potential contributors to public health problems. While it was not a complete risk assessment, the method provided enough information to draw conclusions about the likely role of some kinds of air pollution in public health and is a good basis for priority-setting and for evaluating potential cumulative effects.

It might be helpful to make it very clear at the start what the project can and cannot accomplish because, while it did answer the narrow question being asked, it did not answer the broader concerns of the community.

The report should comment on how the members of the technical committee were chosen. Did the nontechnical community members and environmental advocates participate in the selection? Trust in the outcome might have been improved by allowing all participants to take part in selecting those who conducted the actual screening efforts.

It might also be interesting to know how the nontechnical community members reacted to the screening concept. I often worry that a big risk communication challenge is presented by identifying a list of chemicals of potential concern in an early screen and then eliminating them by further screens. (Just

kidding! They weren't toxic after all!) I think this problem was recognized by the air committee, but some elaboration on their concerns and how they were addressed might be instructive.

Specific Charges

1. Emissions inventory. As noted above, future projects should include mobile sources.

2. Initial screen. (a) The screening methods were pretty crude, but that's why they call it an initial screen, I guess. The methods were justified by science policy more than by science. (b) The screening criteria were appropriate. They were certainly health-protective, but not so extreme that all chemicals were tagged as being of concern for the next tier.

3. Subsequent screens. (a) I am not technically qualified to comment on the exposure assessment methods. (b) The screening criteria were appropriate, for the same reason as above. (c) The assumptions underlying the Region III risk-based concentrations are okay for a screening exercise, which this was, but not for performing risk assessments. Some additional explanation regarding the choice of RfDs instead of RfCs would be useful.

4. Committee report. The draft committee report accurately describes the screening exercise and its results, but I agree with the authors that it is probably not very accessible for nontechnical community members. The extra efforts being made to make it so are a good idea.

5. Sensitive populations. Due to the very conservative, precautionary-principle-based assumptions underlying the screening methods, they are sufficiently protective of sensitive subpopulations. In particular, the toxicity estimates are designed to be very health-protective.

Extraneous Comment

The box on page 23 that addresses risks and hazards perpetuates the false "carcinogens are nonthreshold/noncarcinogens have thresholds" dichotomy. A qualifier along the lines of "For regulatory purposes it has been assumed that . . ." should be added, along with the information that current scientific evidence indicates that some carcinogens have thresholds and some noncarcinogens do not.

Peer Review Comments

Douglas Crawford-Brown, Ph.D.

Department of Environmental Science and Engineering

University of North Carolina at Chapel Hill

Review of Baltimore Community Environmental Partnership Air Committee Technical Report.

Douglas Crawford-Brown

Professor

Director, Office of Environmental Academic Programs

Chair, Environmental Sciences and Studies

University of North Carolina at Chapel Hill

A. General Charges

Question 1. I am somewhat divided on the answer to this question. Let me first say that the risk assessment methods used in the report are generally of sufficient quality, and certainly go beyond those normally used in community risk assessments. The Committee should be commended for the effort shown in this report. The risk assessment methodology will provide conservative estimates of risk under most circumstances and, therefore, provide a sufficient basis for claims that health is being protected. In this light, therefore, I believe the assessment will meet the stated goals.

Still, I am always concerned when screening approaches are used to select out a set of chemicals for more refined study. I realize the need to try to narrow the number of chemicals for more refined assessments, especially since the final screen involves data collection on individual chemicals that can require significant time (and would delay risk management decisions). The first screening level is presumed to produce highly conservative results. The presumption is that the final level of screening, if it were performed on those chemicals excluded after the first screen, would always produce risk estimates that are lower than the values in the first screening calculations. If this is the case, the purpose of the first screening will have been satisfied (i.e. it will have excluded chemicals that would have been shown to pose no appreciable risk in the final screening, thereby saving resources and time).

But I see no explicit demonstration that the presumption above has been satisfied here. I SUSPECT it was satisfied, since it usually is satisfied in my own experience, but there also are cases in which it is not satisfied. One way to check this would be to ensure that, for the chemicals passing all the way to the final screen, the risk estimates under the final screen are, in fact, less than those estimated in the first screen. This would provide greater confidence that the chemicals excluded by the first screen were not likely to pose a greater risk under the assumptions of the final screen.

In addition, by removing chemicals at the first screen (in fact, by removing a large fraction of the chemicals), the Committee raises the possibility that the cumulative effect of these excluded chemicals might be appreciable even if the individual effect falls below a screening risk value. This is always a potential problem

with screening approaches and, again, I am sympathetic with the need to narrow the list of chemicals to allow timely completion of the final screen, but the potential effect of excluding chemicals early in the process of considering cumulative risk should be mentioned.

I also worry a bit that a formal variability and uncertainty analysis was not performed. The goal of such an analysis would be to determine if there might be susceptible and/or sensitive individuals whose risk is larger, and to determine the confidence with which it may be stated that risk goals have been met. Presumably, the Committee is assuming that use of the RBCs and somewhat conservative models already addresses these issues. This may or may not be true. An explicit statement to that effect, with supporting evidence, would improve the assessment and give greater confidence that the public health is being protected. The issue of variability is particularly germane given the recent EPA focus on risk to children (initially under the FQPA and SDWA, which do not apply to air releases, but increasingly in all program offices). The report should state whether risks to sensitive subpopulations, including children, have been modeled adequately.

Finally, I raise an issue with Figure 5 on page 49. In that figure, it appears to me that 88% of the benzene measured at the FMC monitoring station is unaccounted for. I am not sure what this means, and the report is not clear. Does it mean that the measurement is a factor of almost 10 below the measured concentration? That is how I interpret the results. If that is the case, might this suggest that the model in general is underpredictive, and that the degree of underprediction for other chemicals might be similarly large? If that is the case, some chemicals may have been screened out inappropriately. I am not saying this is the case, only that the report does not provide me the information needed to determine if this is the case. Something should be added to the report to address this concern.

Question 2. I will address the parts of this question in separate paragraphs in the order in which they appear in the charge.

Mobile source modeling would be desirable scientifically, but it is a very difficult form of modeling. Collecting the data bases, separating emissions by time of day and season, estimating route patterns, estimating length of time a vehicle has been running (which affects emission rate), etc, is a daunting task, especially when it is placed on top of the task of estimating concentrations from stationary sources. Still, it would improve aggregate and cumulative risk estimates, and would help identify other risk management options. Of the 8 additions listed, I rate this addition 5 (on a scale of 1 being lowest priority and 8 being highest).

I feel the sources identified are an adequate representation of the total sources. I believe it is unlikely additional sources will change the risk results appreciably. I rate this addition 2.

The IRIS and HEAST databases are the appropriate ones for such information. The OSW is considering an expedited review process for assigning toxicity (RFD/RFC and CSF) for chemicals not currently in IRIS or HEAST as part of their HWIR project. The Committee might consider contacting that office and seeing

where this process stands. I rate this addition 6 since it might cause some chemicals to enter final screening that currently are not included due to missing toxicology information.

I doubt that short term acute effects would be missed by the screening methodology. It is rare that these drive the risk assessment and risk management decisions (although there are exceptions). The more common case is that risk management decisions based on protection against more chronic effects is also protective against short term, acute, effects. The exception tends to be when a facility is short-lived, or emits very sporadically, but I see no evidence that these cases apply to this study. I rate this addition 3.

I do believe this is an issue, as discussed in my comments previously. The current hope in developing RfD/RfC values, and CSFs, is that all sensitive subpopulations are included within the uncertainty factors employed. While this may be true, it is a controversial claim at present and so the EPA has been sent back to the issue by Congress in the FQPA and SDWA, with an explicit charge to consider if it is true for children. At the least, the study should include consideration of the issue by determining whether any of the chemicals which just barely missed the screen (i.e. were marginally excluded from the final assessment) might be likely to pose risks to sensitive subpopulations not captured by the current uncertainty factors. I personally believe the current RfD/RfC and CSF values do protect even the most sensitive subpopulations, but it would be best to consider the issue explicitly in the study. I rate this addition 7.

I believe this is an important issue, if not in the first screen at least in the intermediate or second screen. Cumulative exposures can now be estimated fairly routinely with existing models (such as the models used in developing the RBCs), and may show very different results. A particular problem with considering only the inhalation pathway (as in the first two screening levels, unless I misunderstood what was done in these screens) is that ingestion can be a significant contributor to risk for many products of combustion. Mercury, for example, can show a dominant pathway from seafood consumption, and dioxins can be dominated by beef ingestion. The cumulative assessment could easily show that some chemicals excluded at the lower screens should have been carried forward into the higher screens. I rate this addition 8.

I am not sure what is meant by this. One possibility is that it refers to the fact that pollutants in the ambient air may enter the house, and then result in exposures that are higher than those estimated when only ambient air is considered (the methodology used in the study does not seem to consider such a possibility). If that is what is meant, the issue is somewhat important but not likely to significantly change the results of the assessment. Another possibility is that indoor exposures are to be estimated based on emissions in the home itself, as a means to provide a comparative risk assessment. It is increasingly clear that overall risks to health may be driven more by indoor exposures than by exposures to ambient air. These indoor exposures are caused, however, by activities under the control of individuals. My understanding of the current study is that it was intended to identify significant sources of pollution in the ambient air, which is a common good rather than an individual good. So, while such an assessment may help to place risks in context, it probably would not change the overall conclusions on public health protection. I rate this addition 1.

I am not sure what is meant by this issue. GIS is useful not simply as a communication tool, but also in estimating risk. With respect to communication, GIS provides no more information than a well-drawn map (in fact, the GIS data base often is obtained from such a map). So, I do not believe GIS would improve communication, except in the sense of facilitating the production of maps that can be overlain to display regions of highest pollution, regions where subpopulations are located, regions of sources, etc. With respect to estimating risk, I had been presuming that the final screening used something akin to GIS to locate

subpopulations for purposes of estimating exposure. If it was not used in that way, it should be considered but not given high priority unless (1) the focus shifts from individual risk to population risk and (2) the inhomogeneity of exposure is large even in small regions (where the additional information on location of individuals within a grid block might significantly change the risk estimates). Still, people moving about during the day usually obscures the additional information provided by GIS. I rate this addition 4.

Question 3. I liked the partnership and community participation displayed in this study. It is a commendable effort and should be continued. Without it, siting, regulatory and other decisions are likely to remain more contentious than they currently are. Having said this, it is still not clear historically whether such efforts really improve the decision process and make it less litigious. The danger is that a lot of effort goes into such a process, everyone participates until the final report is released, and then parties who do not like the conclusions still sue. But at least everyone has a common point of comparison and no one can claim they were not present when the risks were estimated. So, I am hopeful and recommend extending this method to other communities. We are now in the position scientifically, and with respect to computation and visualization resources, to make models available to such groups that will remove the formerly high barrier of technical expertise needed to produce risk assessments.

B. Specific Charges

1. I believe the source inventory was adequate for this exercise. I believe it is unlikely that additional significant sources will be identified by any more detailed collection scheme.

2. The initial screen was appropriate if the inhalation pathway dominates. The Turner concentrations provide an adequately protective screening tool (I compared them against the results of the plume model in the course of this review and they compared quite favorably to the highest values in the plume). I am worried, however, that chemicals for which the inhalation pathway does not dominate will be excluded incorrectly at this early stage. This is particularly worrisome since it has been my experience that non-inhalation pathways are the dominant risk pathways even for combustion sources, where inhalation risks are most likely to be significant. I believe the Committee should consider this point more carefully. A possibility is to adjust the initial screen by multiplying the inhalation risk by a factor (above 1) that is the highest ratio of total risk to inhalation risk under some prescribed scenario where the full pathway model has been run.

3. The final screen was completely appropriate. I do not believe the secondary screen was really needed, unless it was felt that the time needed to conduct the final screen on 22 chemicals was too large to be of use in decision-making. I continue to worry about the fact that the secondary screen (as in the case of the initial screen) does not consider aggregate risk.

4. Yes, this is a well written report that is simple to follow.

5. I believe it is, but there should be some review in the report of the reason for the Children's Health Initiative, the FQPA and the SDWA amendments, and the implications for this study. At the least, the report should include a discussion as to why current uncertainty factors used in developing RfD/RfC values do or do include the sensitive individuals.

Peer Review Comments

Amy D. Kyle, Ph.D.

School of Public Health

University of California, Berkeley

Review of Baltimore Community Environmental Partnership Air Committee Technical Report

Draft Document prepared by the US Environmental Protection Agency

Office of Pollution Prevention and Toxics, November 5, 1999

By Amy D. Kyle, PhD MPH

Research Scientist and Lecturer

School of Public Health

University of California, Berkeley

Charges to reviewers

A. General charges

1. **Did the screening methodology, as applied in Baltimore, achieve goals A and B, which were to determine if the current aggregate levels of toxics in the air in the Partnership neighborhoods resulting from the multiple industrial, commercial and waste facilities in and around the Partnership may adversely affect community health and (B) to recommend actions to improve air quality in the Partnership neighborhoods (recommendations to be based on the information on risk-based priorities provided by the screening exercise. (C) To build the long-term capacity of the community, including residents and businesses, to take responsibility for their environment and economy.**

The screening methodology did not address the fundamental challenge of how to consider and assess the health significance of the aggregate burden of pollution. Instead, it winnowed down the list of chemicals emitted through a screening process that treated each chemical, and, to some extent, each source, separately. This does not seem to achieve the first goal of the project. There is little integration of hazardous air pollutants and criteria pollutants.

The recommendations in the document for improvements in air quality are limited. They do not address reduction in the overall burden of air pollution but rather focus on the four chemicals identified as being of greatest concern individually. This approach might be more accurately described as addressing the "worst" hazardous air pollutants rather than the aggregate burden of pollution.

It is difficult to assess from a document like this whether gains in community capacity were achieved. Given the ultimate withdrawal of some of the original participants and lack of participation in the screening process, it would appear that there are questions about this.

2. The report identified various technical improvements to the screening methodology. Could the methodology, as modified with the identified improvements, help other communities seeking to understand and improve air quality? Comment on the appropriateness of the improvements listed below and their priority. Are there other improvements that should be considered?

As noted, this methodology does not address the fundamental question of how to consider the aggregate burden of pollution for a community. It relies on a chemical-by-chemical assessment paradigm. This does not appear to be responsive to the basic questions being asked by the community. Addressing the improvements recommended by the committee, though they may be advisable, will not solve this basic problem.

Specifically, it is extremely important to include mobile sources when assessing hazardous air pollutants. Also, area sources, as typically defined by EPA, should be added.

With regard to the "best source" for toxicity data, the problem is not so much identifying the "best" source but rather identifying "any" credible source for relevant toxicity data for many chemicals, especially for inhalation exposure. The fact is that existing sources are simply not adequate. This problem needs to be rectified for assessments like this to truly reflect health significance of pollutants. At this point, it is not responsible to represent the toxicity database as sufficiently complete to allow for full assessment of the likely health significance of hazardous air pollutants, even if the emissions and modeling approaches were impeccable. An assessment based on the current toxicity databases should be represented as a likely under-estimate.

It would be a simple change to include short-term acute effects, though unlikely to lead to important differences in the results.

With regard to the protection of sensitive and urban populations, the issue is not simply the screening calculations but rather that the toxicity data base does not exist for the protection of infants and children from effects of toxic substances. With regard to urban populations, the key issue is the significance of cumulative exposures to multiple pollutants. This methodology, as noted elsewhere, does not fundamentally address this.

With regard to adding indoor air risks, it would seem that there are sufficient issues to address for outdoor air risks. Adding another suite of issues would not seem to be a high priority.

GIS mapping would improve the document and presentation.

Specific Charges.

Comment on the following, given goals A and B.

1. *Emissions inventory – were the inventory of sources and the release and monitoring data used in the Baltimore screening exercise sufficient and appropriate to reach the goals of the committee? Should additional sources be included in a source inventory to expand the scope of the methodology for use in other communities?*

As noted elsewhere, it is critical to include mobile sources when providing assessments of air pollution. Mobile sources should be included in any future assessment project.

It is not entirely clear from the document whether what are usually known as "area" sources are included in this assessment. This analysis appears to use a definition of area sources that is different from what is usually meant by this term. This is rather unfortunate, as this will be confusing to any but the most careful readers of the document. The analysis appears to consider area sources that are like impoundments or lagoons that provide releases of air pollutants over a space that is better represented as an area than a point, in contrast to stationary sources. However, the normal definition of area sources includes many small sources, most of which will not have these characteristics. Area sources may be of particular importance in cases where people live in close proximity. Future such projects should incorporate all the important sources of air pollutants – stationary, area, and mobile sources.

Some pollutants may be present in the environment due to historical releases or may have significant background concentrations. Carbon tetrachloride is an important example of a compound that is no longer widely released but which remains present in the environment. To gain a complete picture of air pollutants, background sources should be considered in addition to current releases.

The monitoring data available for this study were limited to observations from a single site. However, these data were influential in identifying several pollutants that were not predicted to be present in important amounts by the modeling. This might raise a red flag. It may be that, for methodology of this type to be accepted, field confirmation of the predictions is needed. In this case, despite the representations of

conservative and health protective methods, the modeling predicts substantially lower concentrations of all measured pollutants than are actually found. This leads to doubts about whether the predictions are correct. This discrepancy should be discussed in the document. If there is a reasonable explanation for the differences, it should be presented. If there is not, then perhaps future such projects should establish and operate monitors for the periods that are to be monitored to provide a reality check for the modeling.

It may be appropriate to evaluate other models that can accept a broader range of data and better characterize pollution from sources other than stationary sources. The ASPEN model used in the EPA cumulative exposure project appears to have achieved better correlation with monitoring data than the approach used here. A description of this is included in a manuscript been accepted for publication. [1]

Additional information is posted at the EPA website on this project
(http://www.epa.gov/ttn/uatw/cep/paper.html.)

It would seem appropriate to use some verification for the estimates of releases included in this document. These are based on permit conditions and self-reported results. Some field verification of at least some of these estimates would inspire more confidence in the results.

When reviewing monitored data for hazardous air pollutants, it is critically important to determine the detection limit for the methods used. Because there are not standardized methods for hazardous air pollutants, as there are for the criteria pollutants, states may use different methods. Some methods used by some states have detection limits that are higher than health benchmarks. It would be important to determine whether this was the case here and, if so, how any values reported as being below detection were handled.

It is not entirely clear that the area selected for analysis would include all sources contributing to pollution in the target area. The document did not discuss how the geographic area was selected. For some pollutants, transport can be important. If this methodology is to be developed for use in other situations, it would be important to analyze carefully the spatial area that needs to be considered to capture all sources of pollutants that might affect a neighborhood.

---

[1] Rosenbaum A, Axelrad D, Woodruff TJ, Wei Y, Ligocki M, Cohen J. National estimates of outdoor air toxics concentrations. Journal of the Air and Waste Management Association 1999;49:174-185. {I do not have the published paper as yet to send to you.}

2. *Initial screen - Were the methods for calculating airborne concentrations, potential dose, and risk appropriate and scientifically justified? Were the screening criteria that were applied to identify chemicals for further analysis appropriate?*

The methods used for the initial screen do not seem to be consistent with the overall goals of the project, nor with the methods used later in the project. The document recognizes that it might have been better to use some of the methods used in the later screen for the earlier screen.

The goal of the project was to assess the aggregate levels of toxics in the air in the partnership neighborhoods. Yet, the first step in the project was to use a strategy of treating each chemical or contaminant separately and screening out those not found, by themselves, to exceed a benchmark hazard index or cancer risk estimate. This approach would appear to be at odds with the overall goals of the project. If you want to assess the significance of aggregate pollution levels, then you need to consider the aggregate burden of pollution and to use methods that would reflect this.

Within the approach adopted, it does not seem to make sense to use a more health protective approach to screening at a later step in the assessment and to use a less health protective approach at an earlier stage in the screening. Specifically, the first screening step calculates a cancer risk of the modeled concentrations in the target area and compares it to a one in a million risk level. It also compares the dose resulting from a modeled concentration to a reference dose. Yet, at later stages, the approach is to compare the modeled concentrations (or monitored concentrations) to half of similar benchmarks. This does not make sense.

It does not appear that the analysis considered the question of the persistence of chemicals in the environment at any stage. This could be important, as ambient concentrations will reflect both the input to the area and the time that a contaminant remains resident.

The document switches back and forth between the use of the term reference dose and reference concentration. It appears that the approach used is to calculate the equivalent of a reference dose based on reference concentrations. This would be a per body weight dose, but derived from studies and analyses relevant to inhalation exposure. This usage is rather confusing, as in most cases, the term reference dose is used to refer to toxicity through routes other than inhalation, particularly ingestion, while the term reference concentration is based on the toxicity resulting from exposure through the inhalation route. While the approach used here may make sense, it again leads to confusion. Perhaps another term could be selected.

A critical element in the analysis is the selection of the toxicity values used as points of comparison. It would be most helpful if these could be clearly identified at some point in the document. The values used for the initial screening do not seem to appear at all. Only some of those used for the second and third

rounds of screening are included in the materials supplied by Region 3. It would be most helpful to pull out the chemicals reviewed here and compile the various reference values that were used. It is very difficult to answer this question without better information about what was used.

3. *The secondary and final screens - Was the modeling approach for developing estimates of neighborhood concentrations from multiple sources technically sound? Were the screening criteria that were applied appropriate? Were the assumptions built into the Region III risk-based concentrations appropriate?*

Though modeling of air pollution is not my area of expertise, it would appear from a comparison of the modeled estimates and the monitored data that the modeling was not accurate. This suggests that it was not technically sound.

It is not entirely clear what assumptions are being referred to here, with regard to the Region III risk-base concentrations.

4. *Does the draft Committee Report in Appendix J adequately and accurately describe the screening exercise and its results?*

The draft committee report is somewhat difficult to follow and would benefit from the addition of graphics. That said, accuracy could be improved with regard to the issues identified below.

First, Appendix J implies that the modeling captures all of the facilities that are contributing pollutants to the area. Facilities are included only if their emissions exceed a screening level. This means that the modeling will under-predict the overall concentrations.

Second, the appendix does not reveal the discrepancies between the model predictions and the monitoring results. These cast doubt on the accuracy of the modeling. This should be disclosed and discussed.

Third, the appendix does not fully describe the sources that not included in the exercise.

Fourth, the discussion of the screening levels does not explain that each chemical was compared separately to the cancer screening concentrations. The overall cancer risk that might result from combining exposures to many chemicals, each of which is below the screening target, was not assessed. This seems to be obscured in the report.

Fifth, the descriptions of the limitations of the study seem to point to issues that are less relevant than the genuine limitations of this analysis. This appears to suggest that the principal limitation is a lack of data on time and activity patterns. However, there is nothing in the charge to the group suggesting that people expected this kind of detailed information. It appears that they expected an assessment of outdoor concentrations overall. This might be seen as a lower bound on the exposures that individuals might experience, because concentrations are often higher indoors than outdoors. It would be more fair to this process to point out the limitations of the study to answer the initial questions of the people in the

community rather than to point to additional research questions not initially included. Similarly, explanations that emphasize the significance of diet and heredity seem quite beside the point of this analysis, which is supposed to focus on air pollution.

Sixth, the document does not provide the best available estimates of outdoor concentrations of these chemicals, but only of certain of the chemicals that passed a screening process.

5. *Is the screening methodology as used in Baltimore sufficiently protective of sensitive populations? Please suggest any improvements of this aspect of the screening methodology.*

See previous comments.

Page-specific comments.

Page 5. Given the erosion of participation in this project, the sponsors might consider whether it is consistent with the initial design to move forward with a report.

Page 13. The potential for violation of permit conditions is not addressed in this methodology.

Page 16. To reach conclusions from an analysis such as this, it would be important to include all pollution sources, including those noted at the bottom of page 16 as being excluded.

Page 23, first full paragraph. It would seem to be important to have community representation during the selection of screening levels. The lack of representation is troubling.

Page 23-25. A table of values used should be included here. An assessment of the data gaps in the underlying toxicity database should also be included.

Page 26: calculation of the air concentration and potential dose. This method appears to compare the estimated concentration of each chemical at each facility to a screening value. If this is the correct interpretation of the text, it is difficult to determine how this would integrate exposures from multiple sources. If each of ten sources of a chemical each produced a concentration below the screening level, it would be excluded. Yet, taken together, they might result in a concentration of concern, even for a single chemical.

Page 27. For air pollutants, the assumptions of exposure duration of 24 hours per day, 365 days per year, may not be particularly conservative for urban populations. Pollution concentrations are fairly consistent in urban areas; there are not many places people can go to reduce their exposures.

Page 29, table at the top of the page. It is not clear from this table whether the entries represent what might come from one facility or from all of the facilities for the chemicals identified.

Page 30. Should include a summary of the monitoring results, with all chemicals and annual mean values.

Page 30, box. The reasons for excluding these chemicals should be further developed. Some of these chemicals can also have area sources and should not be quickly excluded. Having a committee use "professional judgment" to exclude chemicals without clear explanation is not a transparent process.

Page 30, last paragraph. It would be important to address aggregate exposure at the initial screening step. Otherwise, sources and chemicals have already been excluded. The results described here should be demonstrated in the report.

Page 31, first full paragraph. Several of the criteria pollutants are mentioned here as being included, but the methodology does not seem to address these pollutants.

Page 37, first paragraph. The alternate definition of an area source is given here. This is very confusing. It also appears that those sources usually defined as area sources are not included in this analysis.

Page 37, second paragraph. It would strengthen the analysis to demonstrate the actual emissions are indeed below permitted levels. Compliance or other data might be available to allow this.

Page 40, last paragraph. It would seem appropriate also to consider overall cancer risk.

Page 49. This chart requires some explanation. Again, it would appear to demonstrate that the modeling was not technically sound.

Appendix D. Should include the Region III table, the ATSDR MRLs and the IRIS values.

Appendix I. Should be highlighted. The contrast between the predicted and measured values is striking. Check the detection limit for vinyl chloride.

Peer Review Comments

Kenneth L. Mitchell, Ph.D.

U.S. EPA Region 4

Kenneth L. Mitchell, Ph.D.
USEPA Region 4
November 29, 1999

GENERAL CHARGES

5.Did the screening methodology, as applied in Baltimore, achieve goals A and B?

In a broad sense, the Study did achieve the goals outlined in A and B. The analysis did lead to an assessment of the levels of toxics in the Partnership neighborhoods that may adversely affect community health. And the report does include specific actions to improve the air quality in the area. However, as discussed below, the efficacy of the methodology used to accurately reflect the potential health impacts of air pollutants can be improved upon.

6.The report identifies various technical improvements to the screening methodology. These are listed below. Could the methodology (emissions inventory, initial screen, secondary screen, final screen), as modified with the improvements identified below, help other communities seeking to understand and improve air quality? Please comment on both the appropriateness of he improvements listed below and their priority. Are their other improvements that should be considered?

The methodology, as modified with the improvements identified below, could help other communities seeking to understand and improve air quality.

1.Add mobile source modeling: The Baltimore exercise focused on stationary and area sources. This task will expand the capacity of the methodology to include mobile source modeling.

The methodology would benefit strongly from the inclusion of mobile source emissions and an evaluation of their impact on the overall concentrations of toxic chemicals in ambient air. (Indeed, the document would also benefit from some analysis of the impact of all criteria pollutants as well.) It is clear from recent modeling exercises (USEPA, 1999)[2] that mobile sources can have a very significant impact on the overall quality of air, particularly in urban areas. An appraisal of these sources will lead to a much better understanding of the problem at hand as well as more effective strategies for protecting public health. (High priority)

[2]See http:\\www.epa.gov\cumulativeexposre

2.Review and improve the source inventory review: Review existing source inventories to identify additional sources of emissions to ensure that all significant sources are included.

A well developed emissions inventory is crucial to the success of a screening process. However, there is a point of diminishing returns where tracking down every small release may provide little additional information (unless there is some reason to believe that there are so many small sources that, in toto, they would prove a significant source). Based on my more limited knowledge of building source inventories, the level of detail identified in this document for the development of a source inventory seems appropriate and should suffice to meet the goals of the project. (Medium to low priority)

3.Identify the best source for toxicity data: Compare available toxicity data bases to identify the most accessible and complete source(s) of data for community screening exercises.

It is crucial that toxicity values which have been peer reviewed by persons knowledgeable in the field of toxicology and epidemiology be used to evaluate potential health impacts for toxic air pollutants. Given that a number of such values may exist for any given chemical, it is also crucial for trained scientists to review the available literature and select toxicity values that are scientifically supportable.

A complication in the toxicity factor selection process is that a number of science policy decisions must be made. For example, if a particular chemical is generally considered to be a potential human carcinogen, but there is disagreement over the published findings in the toxicological or epidemiological literature about its relative potency, a decision must be made as to whether and how far one will go in developing a carcinogenic potency slope factor. Any number of other "science policy" scenarios can be mentioned which affect almost any health assessment (including the one described in this document).

It is crucial, therefore, *that before a study begins*, the stakeholders identify a hierarchy of toxicity data sources as well as decisions on how they will address the numerous science policy issues that will come up during the assessment. The assessors should then apply these decisions consistently throughout the entire process. For example, in this document, step 1 apparently relies on IRIS and HEAST toxicity values only. Step 2, however, uses the Region 3 RBC methodology (which relies on IRIS, HEAST, and several other sources of toxicity information). Unless there is good reason (e.g., updated toxicity studies), "changing course in mid-stream" on toxicity issues or science policy determinations can seriously compromise the overall supportability of an assessment.

This is not to say that the process cannot include flexibility. Indeed, stakeholders may wish to delve into the literature in their search for a supportable toxicity value. Nevertheless, a

process for performing such evaluations should be established at the outset of the assessment, with a clear understanding of when such an analysis will be undertaken and by whom. (High priority)

4.Expand the Baltimore methodology to include short-term acute effects.

Acute toxicity is clearly an important issue for communities and should generally be addressed by the methodology. One issue with acute toxicity evaluations is the lack of consistently derived toxicity values appropriate for the types of exposures that would be of concern in such evaluations (i.e., acute toxicity values protective of the general public under routine exposure conditions).

Similar to chronic toxicity information, it will be crucial for any acute exposure evaluation to clearly define the rationale for the selection of the toxicity values used in an assessment. For example, the use of occupational values divided by some uncertainty factor would need clearly stated and supportable evidence that such a methodology would result in screening values appropriate for the exposures at hand.

One recent attempt at deriving acute toxicity values protective of the general public under routine exposure conditions was undertaken by the California EPA. We suggest reviewing their methodology for developing Acute Reference Exposure Levels[3] if acute assessments are to be included in a later edition of this methodology. (High priority)

5.Review the screening calculations to determine if they are appropriate for and protective of sensitive and urban populations.

As noted elsewhere in this document, the current screening calculations should be reviewed with an eye towards establishing and documenting the logic behind the screening process as well and the numerous technical details that form the basis for the methodology. In its current state, there are technical flaws which call into question the appropriateness of this methodology for evaluating impacts to sensitive and urban populations. (High priority)

---

[3]California EPA (1999), *Technical Support Document for The Determination of Acute Reference Exposure Levels for Airborne Toxicants as part of the Air Toxics "Hot Spots" Program Risk Assessment Guidelines*, Office of Environmental Health Assessment, March (http://oehha.ca.gov/scientific/acuterel.htm).

6.Develop a method to screen for cumulative exposures in the Initial Screening Step.

The initial screening step should take into account the potential for aggregate risks and hazards from contemporaneous exposures to multiple carcinogens and noncarcinogens.[1] One way to do this is to use the maximum concentration found or estimated within the study area and to compare it to an individual chemical concentration that is set at a level which, in and of itself, accounts for the potential for multiple chemical exposures. For example, carcinogenic screening numbers could be set at a level of 1E-06 and noncancer screening numbers could be set at a hazard quotient of 0.1. These values are selected for the following reasons:

Carcinogens: The level of 1E-06 is selected since it would take simultaneous exposure to 20 chemicals all present at a level of 1E-06 to collectively reach a cancer risk of 1E-04, the commonly accepted upper end of acceptable risk. Since this would be an unlikely situation, the screening level of 1E-06 is a reasonable and conservative starting point for the screening process.

Noncarcinogens: The hazard quotient of 0.1 is selected since it would take a simultaneous exposure to 10 chemicals all present at a hazard quotient of 0.1 to collectively reach a hazard index of 1, the commonly accepted upper bound for noncarcinogenic chemical exposures. Since the toxic effects of noncarcinogens range widely across a variety of metabolic mechanisms and target organs, it is unlikely that one would be contemporaneously exposed to 10 chemicals all present at a hazard quotient of 0.1 and all exerting the same toxic effect. As such, the screening level of 0.1 for an individual hazard quotient is a reasonable and conservative starting point for the screening process. Similar to the screening of carcinogenic chemicals, the maximum concentration found or estimated should be compared to the screening value in this first screening step. (High priority)

7.Expand the methodology to include indoor air risks to provide a more comprehensive picture of air risks.

Whether or not to include indoor air risk is very dependent on the goals of the project. If a goal is to provide a more comprehensive picture of overall air risks, the stakeholders must understand from the outset that the sources and types of indoor air contaminants can be very different from those in ambient outdoor air. In addition, stakeholders must also understand that indoor air across a geographic region can be highly variable, making it difficult to assess

[1] We presume that the authors mean "cumulative" here to be the sum total of contemporaneous toxic exposures to carcinogens and noncarcinogens by the inhalation pathway. We suggest avoiding the use of this term since EPA is currently evaluating the concept of "cumulative risk" to include multiple pathways. Cumulative risk, in that sense, means a more holistic evaluation of risk than that posed by just one pathway.

in a representative fashion for inclusion in a comprehensive risk-based screening assessment. This is not to say that any assessment should not at least discuss the prevalence and effects of common indoor air pollutants (e.g., second hand smoke). (Medium to Low priority)

8.Incorporate GIS mapping to enhance the communication of the modeling and screening results.

This is an excellent suggestion and every effort should be made at the outset of a project to incorporate this vital tool in not only the analysis of data, but also its presentation. However, a note of caution is appropriate. It is very easy to put environmental and public health data on a map and draw conclusions. It is more challenging to put environmental and public health data on a map correctly and come to the correct conclusions. Factors as simple as the scale chosen for mapping data can have a strong influence on the ultimate interpretation. Extreme care must therefore be taken when deciding to map data using GIS. Ultimately, stakeholders must understand the limitations of GIS, the level of data that will be needed to draw supportable conclusions, and the high level of resource requirements (including necessary specialized technical expertise) before committing to using this tool. (Medium to High priority)

9.Are the partnership and community participation aspects of the screening exercise described in the case study and in the lessons learned section appropriate to achieve goal C? Could this screening exercise be used in other geographic areas to reach this goal? Can you identify any improvements or changes in the screening exercise that would help accomplish this goal?

The technical document and lessons learned section of this document do a reasonably good job of describing the process of identifying and including appropriate stakeholders in setting up, running, interpreting, and communicating a screening evaluation and results. While these activities are the important foundation for Project Goal C, this Project Goal is more prospective in scope. In other words, Project Goal C is really geared towards how to use the results of a properly carried out screening project to take action, not simply how to get people together to do a screening project. In that sense, this document does not meet the needs of Goal C, nor could it be used as an example for other communities attempting to meet this goal.

To achieve Project Goal C, stakeholders must all agree up-front to a plan of action that is dependent, in part, on the outcome of the screening evaluation. This is commonly done by developing a "Risk Management Plan" prior to performing any screening level work. The contents of such a plan can include information on acceptable risk levels, guidelines for voluntary pollution prevention activities, funding and education to enhance stakeholder involvement in carrying out these actions, and strategies for sustainable development that meet the need to maintain a health environment. The Plan may even go as far as to envision changes in existing statutory or regulatory authorities to effect environmentally beneficial results. Ultimately, the plan can say anything the stakeholders want. However, having such a plan and obtaining buy-in from all affected parties *prior to beginning*

the screening process will form the basis for Project Goal C to be achieved. The current document appears to include very little of what could be described as a risk management plan. (High priority)

SPECIFIC CHARGES

1. **The Emissions Inventory. Were the inventory of sources and the release and monitoring data used in the Baltimore screening exercise sufficient and appropriate to reach the goals of the committee? Should additional sources be included in a source inventory to expand the scope of the methodology for use in other communities?**

See responses to 2a and 2b under General Charges above.

2. **The initial screen: (a) Were the methods for calculating airborne concentrations, potential dose, and risk appropriate and scientifically justified? (b) Were the screening criteria that applied to identify chemicals for further analysis appropriate?**

a. The method selected appears to be reasonable for calculating airborne concentrations, potential dose from a predicted concentration, and risk/hazard. However, comments given elsewhere in this review should be taken into account to refine the method to make it more justifiably conservative as a first step in a tiered screening approach. For example, noncancer doses should be compared to a HQ of 0.1, not 1.

b. As noted elsewhere, a modification of the screening criteria would make this initial step more conservative and more appropriate.

In addition, there are several troubling statements in the document regarding the addition or deletion of chemicals based on "professional judgment" (see pp. 30-31). Such decisions must be thoroughly documented so that anyone may see the precise logic behind the decision. For example, consider the phrase (p. 30) "Aldrin, acrylamide,....were not selected for further evaluation...because the professional judgment of the Committee determined that the chemicals did not present a risk to the community." A stakeholder not involved in this decision would be quite justified in questioning this statement (given the lack of supporting documentation). Also, while there is some logic to including chemicals for which there is no toxicity data, one could also make the argument that refining their airborne concentrations by modeling is an extraneous exercise since one still does not know what such refined concentrations mean toxicologically. The document should discuss this uncertainty.

3. **The secondary and the final screen: (a) Was the modeling approach for developing estimates of neighborhood concentrations from multiple sources technically sound? (b) Were the**

screening criteria that were applied appropriate? (c) Were the assumptions built into the Region III risk-based concentrations appropriate?

a. Based on my more limited knowledge of modeling, the approach appears to be technically sound with the caveat that the document is extremely ambiguous on how and why the receptor grid system and selected receptors were selected. For example, why was a coarse grid system even contemplated (since it was not subsequently used) and how were the receptors points that represent the four neighborhoods selected (are they located at census tract population centroids, near sensitive subpopulations, etc.?). Also, are the modeled concentrations used in the screening at a grid receptor the aggregate concentrations from all sources? What was compared to the screening level (the maximum annual aggregate concentration at a receptor)? Where is the monitoring station on the receptor grid and was this also selected as a modeling receptor point?

b. The screening criteria could be appropriate had they not been juxtaposed with a different set of screening criteria in Step 1 (different toxicity values, etc.). For example, the Region 3 RBC values are commonly used for screening contaminant levels in environmental media and are appropriately used in this evaluation. However, they include a set of presumptions about exposure that are logically inconsistent with the screening criteria used in Step 1 (presumably the most conservative step). Specifically, Step1 presumes an adult exposed for a lifetime. The RBC values, on the other hand presume (for carcinogens) a person exposed for only a portion of a lifetime (30 years), part of which is exposure as a child and part as an adult. Apparently the Committee intended to deal with this inconsistency by dividing the RBC values in half. While dividing a carcinogenic RBC value in half gives a value approximately that of assuming an adult exposed for a lifetime, for noncarcinogens the same operation gives a screening concentration that is half that of the Step 1 screening values. This is because, for noncarcinogens, the exposure duration term cancels out of the hazard equation (i.e., the length of exposure is irrelevant). Thus, the Committee has selected, for noncarcinogens in Step 2, screening values that are twice as conservative as those of Step 1. And Step 1, by definition, is supposed to be the most conservative step.

One way to correct this inconsistency would be to reconstruct the overall screening process as follows:

(i) Select a conservative set of screening values (e.g., the Region 3 RBC values).

(ii) Use these values at a level of 1E-06 for carcinogens and one-tenth their value for noncarcinogens (to account for possible contemporaneous exposure to multiple noncarcinogens that have the same mechanism of action or affect the same target organ).

(iii) Calculate concentrations as described in Step 1 (i.e., using Turner's method) and compare the MAXIMUM concentration found or estimated in any airshed to the screening level. Keep only those chemicals that fail the screen.

(iv) Perform modeling as in Step 2 on those chemicals that failed the initial screen. Compare concentrations at selected receptor points and monitoring stations to the SAME screening levels used in the initial screen. Keep only those chemicals that fail the secondary screen for any given airshed.

(v) Use refined modeling to compare the failing chemicals to the SAME screening levels used in the initial screen. The chemicals that continue to fail are then the ones targeted for reductions.

Ultimately, such a screening methodology maintains a consistent set of toxicological values to derive screening levels at a set level of risk or hazard (all conservative since this is still only a screening method – not a risk assessment). One simply refines the actual concentrations in air from conservative to more realistic. In addition, one may also build in the option to use modeling results at a monitoring position, rather than the monitored values themselves, depending on site specific circumstances (e.g., problems with the credibility or age of the monitoring data).

c. The assumptions build into the Region 3 RBC values are reasonably conservative and generally appropriate for screening programs such as the one described in this document. However, the values should be reevaluated as we learn more about exposure patterns and responses, or have reason to believe that the exposures presumed by the RBC methodology are not protective for a particular site. For example, the RBC table presumes an exposure duration of 30 years (based on residency evaluations). If a particular population is known to be less mobile than that presumed by the RBC methodology, alterations to that methodology (i.e., to derive more strict screening values) would be in order.

4. **Does the draft Committee Report (see Appendix J) adequately and accurately describe the screening exercise and its results?**

With a few exceptions, the Committee Report and the technical document are consistent. However, we suggest addressing the following points:

a. Appendix J indicates that only carcinogenic screening values were used in the screening process. This was not the case.

b. Appendix J also tends to give details not present in the technical document. If anything, the technical document should include everything in Appendix J. For example, Section 5 of Appendix J indicates that the model was used to determine chemical specific aggregate concentrations at grid receptors. The technical document is more ambiguous on this point. Likewise, Appendix J goes into details about what is being done, say, on the national level about air emissions, whereas the technical document provides less detail on this point.

5. **Is the screening methodology as used in Baltimore sufficiently protective of sensitive populations? Please suggest any improvements of this aspect of the screening methodology.**

With the modifications suggested elsewhere in this comment document, the Baltimore evaluation could be sufficiently protective of sensitive populations. For example, the modeling efforts should much more clearly define why grid receptors were chosen where they were. If these grid receptors do not include the locations of sensitive subpopulations, any new evaluation should be augmented to include the locations of such populations located in the study area (i.e., day care facilities, schools, nursing homes, and hospitals).

ADDITIONAL COMMENTS

1. The technical document suffers from a critical lack of detail in both the both the logic of the selected screening process as well as the scientific basis for the methodology. While a verbatim recitation of standard technical detail and policy is not necessary, sufficient citations to relevant texts are, and there are virtually no citations in this document. In short, anyone should be able to pick up this document and be able to understand exactly how the authors arrived at their conclusions.

Carol Browner's policy on the development of Agency risk characterization[2] intimates that all such Agency documents must be clear, transparent, reasonable, and consistent. While the Baltimore methodology does not present a "risk characterization" per se, it should nevertheless meet the spirit of the risk characterization policy. As such, it is suggested that this document be rewritten with an eye towards including substantially more detail.

2. There are a number of examples of risk screening methodologies that have been evaluated and tested, but which are conspicuously absent from this document. Indeed, there is the appearance of this methodology having been developed quite de novo. We suggest that the authors review alternate methodologies and include a thorough discussion of these methods in the text of the technical document. The purpose of such a discussion would be to show that the developers of this methodology reviewed and understood the existing literature on the subject of environmental screening methodologies and adapted it to the specific needs of the Baltimore study. Some example methodologies that provide insight into the environmental screening processes include:

   - Guinnup, David E., *A Tiered Modeling Approach for Assessing the Risks due to Sources of Hazardous Air Pollutants*, USEPA Office of Air Quality Planning and Standards (EPA-450/4-92-001).

---

[2]USEPA (1995), *Policy for Risk Characterization at the US Environmental Protection Agency*, Office of the Administrator, March 21.

– . *Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites*, American Society for Testing and Materials (E1739-95e1), West Conshohocken, PA, 1999.

2. Page 17, first paragraph states that the partnership area included ZIP codes 21225 and 21226, but then goes on to include 8 additional ZIP codes. We suggest clarifying the exact boundaries of the study area and highlighting it on a map.

3. Page 17, the first paragraph indicates that permitted facilities and TRI facilities were used to make the final list of master facilities. We suggest describing the types of facilities that require permits under Maryland law. As written, one is left wondering whether there are numerous unpermitted facilities, the emissions from which (collectively) could amount to a large portion of the overall environmental load.

4. We suggest including a table that summarizes the emissions inventories that were queried, the type of data available (i.e., chemicals reported and type of emissions data such as total pounds released per year, etc.), the years data was available, the specific data element that was ultimately used in the screen, and a rationale for inclusion in the analysis. For example, if TRI data was available for multiple years, which year was used in the screen and why?

5. The discussion related to the Fairfield monitoring site (page 30, first full paragraph) indicates that 4 years of data have been collected from which annual average, minimum, and maximum concentrations were available for 41 different chemicals. Which year was used in the screen? Which value was compared to the screening value? The maximum? The annual average? (NOTE: The use of the maximum monitored values or estimated value for any source is particularly important in Step 1 of the screening methodology, since aggregation of source contributions is not performed.)

6. The text of the technical document often provides a range of years for which data is available, but for which the analysis apparently focuses on just one year. For example, the first full paragraph on page 19 indicates that ambient air monitoring data from the five Baltimore sites for 1992-1996 were compared to the monitoring station in the partnership area (in Appendix J). A review of Appendix J, however, shows that this analysis was for only one year (1996) and only 4 chemicals.

7. We suggest clarifying the text to indicate that the screening value at a grid receptor is the sum total for a chemical from all modeled sources. This is not clear in the document.

8. Page 27, sentence beginning "A very conservative estimate...," this paragraph indicates that an inhalation rate of 1 m^3/h is presumed. However, the document then goes on (in the highlighted box on page 28) to state an inhalation rate of 20 m^3/d. The second inhalation rate (i.e., 20 m^3/d) is correct and should be used consistently throughout the analysis for adults.

9. Page 40, the section on grouping chemicals according to "similar organs or physiological systems" needs to be reconsidered for the following reasons:

- Apparently only respiratory and neurological effects were evaluated (with the neurological evaluation missing from Appendix I). Any analysis of the disaggregation of hazard indices should consider the full range of mechanistic and target organ effects. There is no rationale provided for the selection of these two effects or whether these are even the critical effects for the chemicals evaluated.

- The "target organ effect" analysis is generally only used in the determination of whether hazard indices in a risk assessment should be disaggregated based on mechanism or target organ effect. What apparently has been done here is to compare modeled concentrations of chemicals exerting similar toxic effects to screening levels to determine if they exceed (in aggregate) these screening values. In concept, such a comparison can only be made comparing doses to toxicity metrics (RfDs) to derive a hazard quotient. The additivity of the various hazard quotients is an assessment based on mechanism of toxicity or target organ effect.

  Appendix I indicates, however, that comparisons of doses have been made to a variety of screening levels, some of which are not toxicity metrics (e.g., sulfur dioxide is compared to the National Ambient Air Quality Standard - NAAQS - for this compound). This results in the development of hazard quotients and pseudo-hazard quotients which cannot be added using the hazard index methodology. Adding such values together leads to an entirely erroneous result. It is suggested that the authors either consult a toxicologist with demonstrated experience in the application of the principles of the hazard index methodology or drop the analysis from the document entirely.

  The above discussion highlights a related problem that recurs throughout this analysis: namely, an undocumented selection of toxicity and pseudo-toxicity metrics and the use of screening values which are not toxicity metrics to quantitate risk or hazard. As noted previously, NAAQSs are not toxicity metrics and cannot be used as such. Neither are ACGIH TLVs divided by an uncertainty factor (sulfuric acid), nor ATSDR MRLs.[1] We suggest reevaluating the basis for toxicity metric selection and to apply it consistently throughout the document.

  Please note that none of this is to say that concentrations should not be compared to non-toxicity metric screening levels. For example, comparison of air concentrations to the NAAQS is not only permissible, but desirable. The point is that such an analysis cannot be subsequently used in assessing hazard quotients or additivity of hazard quotients using the hazard index approach.

---

[1] ATSDR MRLs can theoretically be used, under limited circumstances, as a toxicity metric due to the similar nature of their development to EPA RfDs. However, a justification must be made for such a use, and the uncertainties of the analysis documented.

10. Table 3 on page 46 indicates "NA" for a number of secondary screen emission rates which have final screen emission rates. How can this be? If the final screen is a refinement of the secondary screen, the secondary screen should have emission rates for all of these chemicals.

11. Table 4 on page 48, we suggest discussing why some of the estimated concentrations in the final step are higher than estimated concentrations from the secondary screen. One might presume that, given the supposed increasing conservativeness of the screen steps as one goes from Step 3 to Step 2 to Step 1, that Step 3 estimates might be less than those of Step 2. We also suggest adding the three monitored chemicals to this table to make it more comprehensive.

12. We suggest making the screening methodology flexible when determining whether to move from one step to another. Generally, screening methodologies of this sort may or may not complete all steps, depending on site-specific circumstances. For example, the initial screen might clearly point to one source as the primary emitter of concern. Spending more time and money on screening would probably not change that conclusion. In this instance, stakeholders might decide to take action after the first step and drop any further analysis.

13. Page 62 indicates that one lesson learned would be to verify modeling results with monitoring results. Performing this analysis should not be a lesson learned for this document. Rather, it is crucial that this analysis be done for this version of the document since this is the primary way, in this study, to "ground-truth" the estimates from the model.

14. For the Fairfield monitor, the document should state whether it is a source-oriented monitor or a community-based monitor. A source-oriented monitor is positioned specifically to determine whether a particular source is affecting a particular population. A community-oriented monitor is positioned so as to provide readings suitable for estimating exposure over a larger geographic area (e.g., a large urban area). This same comment holds for the other Baltimore area monitors mentioned in Appendix J.

15. We suggest reviewing Appendix G for accuracy. For example, cancer slope factors are given as mg/kg-d rather than $(mg/kg\text{-}d)^{-1}$. We also suggest removing extraneous information that is not used in the screening process (e.g., the waste minimization prioritization tool - WMPT – information).

16. Appendix I, Table 1, the "Screening Comparison Concentrations" are not one-half of the Region 3 RBC values, as indicated in the text. For example, the screening value for ammonia is given as 100 ug/m^3. One-half the RBC value is 50 ug/m^3. We suggest revising this Appendix and the text to match. (Also note that there are not similar screening comparison tables for Steps 1 and 3, but there should be.)

    We reiterate an aforementioned comment here, given how crucial it is to the overall success of the screening process. Table 1 of Appendix I illustrates that there is little documentation or justification for the selection of screening levels (for any of Steps 1-3) or how they are applied. We strongly suggest revisiting this question and revising the methodology accordingly.

17. Appendix J, Numbers 9 and 13 should be enhanced to more fully describe the Clean Air Act requirements to address air toxics in urban air, including a more thorough discussion of MACT standards, the residual risk program, cleaner fuels, etc.

18. Appendix K, the discussion of the modeling provided in this Appendix does not match the text of the body of the technical report (e.g., the text does not talk about multiple modeling scenarios).

Why were the 5 years for modeling (1987-1992) selected instead of more recent years? Were the results from these different modeling years evaluated separately or combined in some way?

19. What was the rationale for the selection of the discrete neighborhood receptors (e.g., Cherry Hill at a given lat/long)?

20. The document should include a much more full description of the airsheds and meteorology of the area. Basic information such as windroses is missing from the document and should be included to frame not only the problem, but also for use in developing appropriate solutions.

21. The document should include a thorough analysis of uncertainties associated with the assessment and their effect on the analysis outputs. Only by including such an analysis can one determine whether decisions can be made with the current level of analysis or whether additional work must be performed (to reduce existing uncertainties) before any risk management decisions can be made.

Peer Review Comments

Ronald E. Wyzga, Sc.D.

Electric Power Research Institute

Overall Comments

The document presents a tiered approach to evaluating community risk due to modeled levels of air contaminants in neighborhoods of southeast Baltimore City and contiguous Anne Arundel County, Maryland. The approach begins with a screening list of chemicals of interest from TRI and state release inventories, and an inventory of fixed facilities in the area that might emit those substances to air. Then three successive air quality modeling and constituent screening exercises are carried out to calculate potential incremental health risks in the neighborhoods being studied. The resulting calculations showed that only benzene was identifiable as being both currently emitted from the inventoried fixed sources, and posing a potential air concentration above the risk-based concentrations used for screening levels of concern. The remaining three chemicals were identified as not being due to emissions from current fixed sources (1,3-butadiene, methyl chloride, and carbon tetrachloride).

The general approach taken seems reasonable, although there are significant gaps in the information provided about the conclusions reached. In particular, no explanation is given for screening or higher level analyses of chemicals whose primary exposure route of concern is ingestion or other non-inhalation pathways. Although both dioxins and mercury, for example, are listed as having been selected in Level 1 screening because of risks levels of concern (hazard quotient > 1 or cancer risks > 10^{-6}), these chemicals are of concern primarily by ingestion routes indirectly through foods. In particular, dioxins are lipophilic, so are of concern due to ingestion of meats and dairy products, while mercury requires fish ingestion. Yet no discussion is provided of the manner in which screening risks were calculated for these chemicals. Nor is any discussion provided of whether these chemicals arise from local sources, or from "ambient" levels (levels in background media with no attribution to local sources). Thus it is not clear about how such chemicals can be screened in or out of the subsequent analyses.

Although the approach is reasonable, its limitations make it of limited value. The lack of congruence between the methodology results and the monitoring data is disturbing. It suggets that the results of the current methods are of questionable value.

General Charges

1. I don't believe that these goals were met. The greatly limited emissions inventory would not allow any reasonable assessment of community health impacts. It is imperative to consider mobile sources, volatile emissions from landfills, etc. and small sources. Each of these has potential to contribute significantly to community risks. Analyses by EPA (1990) indicate motor vehicles and related activities (fueling & fuel processing) may account for about 75% of their calculated excess cancer cases nationally, or 75% of 1,700 to 2,700 cases annually. Since then, the unit risk for 1,3-butadiene has been re-evaluated and cut by a factor of about 3, but it is likely that other fuel constituents play a significant role that was unaccounted for in 1990. One reason given for the meaningful divergence between the monitored values of 1,3-butadiene, methyl chloride, carbon tetrachloride, and benzene is the potential emissions from wastes sites and landfills. If these emissions are sufficient to be monitored and trigger risk concerns, they cannot be ignored. Small sources could also be important. I'm not sure that the current methodology, for example, would capture the impact of a small dry cleaning establishment whose emissions of perchlorethylene might reach immediate neighbors.

Without any reasonable characterization of risks, the methodology is of little value in aiding the development of risk-based priorities.

The most important conclusion that I make from this exercise is the importance of monitoring. The method did not identify the greatest potential risks; monitoring activities did. I would urge the expansion of monitoring to include other sites and a full suite of toxics about which there is concern. This has far higher priority than the extension of a methodology whose results to date are not validated by monitoring data.

If the methodology is to be extended, the most important improvement is the development of a comprehensive emissions inventory. See my comments above. This is not an easy task for the sources currently missing; perhaps community involvement could help here.

To be consistent with other EPA studies, toxicity data should be from the IRIS database. It should be recognized and communicated to the community that the unit risks and RfDs/RfCs are conservative numbers designed to be protective: risks derived from them are upper limits. The IRIS numbers, however, are based upon a thorough (although sometimes out of date) review of the literature and their derivation is well-articulated.

Short-term acute effects could be important; their consideration need also includes potential accidents, which would require all types of probabilistic assumptions. The consideration of acute effects and exposures would also present modeling problems. I would urge the study group to estimate the chronic risks correctly before venturing off into an even more difficult area.

The EPA risk assessment guidelines (and the data and methods applied) make provision for sensitive individuals. Unless there is good reason to suspect that these are not sufficiently protective for the population under study, I would not revise them.

I would give lower priority to applying GIS mapping systems and cumulative exposures until we have far more confidence in the existing results.

I would ignore the indoor environment; this would require too many assumptions and would not be appropriate for this study. Where the indoor environment would mitigate ambient concentrations may be of interest, however. For example, SO2 and ozone are both adsorbed on indoor surfaces; hence, indoor levels of these pollutants are far lower than outdoor concentrations.

It is difficult to evaluate goal C from the materials provided. Clearly there must be scientific confidence in the results of the screening study. I don't have confidence in these results at present; the divergence of the results of the screening exercise and the monitoring program do not provide confidence in the results. The lack of any clear explanation of how to interpret the results of the study to the community is also a detriment. The study is seriously limited because it ignores many potentially important sources; on the other hand, it employs a very conservative methodology that will overestimate risks. Neither of these are clearly communicated in the report. I believe that this is necessary to obtain the respect of the community.

Specific Charges

1. See my comments above. I believe that the current inventory was neither sufficient nor appropriate.

   The initial screen was reasonable for large sources. I'm not sure if it would have captured the hypothetical dry cleaning establishment that I mentioned above. These smaller sources may be more important because they are emitted at ground level.

   The above could also apply to the secondary and final screens. There should have been greater attempts to understand the discrepancy between the results of these screens and the monitoring data.

   Appendix J provides an accurate description of the process.

   The methodology as applied in Baltimore is of limited value; it ignores potentially very important sources; it does not provide results which are consistent with monitoring data. It applies very conservative methods to a few well-defined sources. See some of the specific comments below which indicate areas where the methodology could be made less conservative and still be protective. Before this methodology is applied elsewhere, it needs to be improved and shown to agree with the results of monitoring data in Baltimore.

Specific Comments:

Pg. 9, second bullet	"The actual risk ...". The use of the term "actual" is imprecise and nonstandard for risk calculations. The word "actual" is used throughout the paragraph. It would be more correct to state that "The site-specific potential risk based on field measurements of concentrations ... could not be determined."
Pg. 24, last paragraph	The definition of a Reference Dose should be expanded a bit to make it clearer. The units of an RfD need a bit of explanation; it refers to dose in mg *of the substance of interest* per kilogram *of subject's body weight* per day.
Pg. 25, first full paragraph	The example given for cancer risk, $6 * 10^{-4}$, seems unusually large when all of the results arrived at later are 2 orders of magnitude or more lower. Suggest $6* 10^{-7}$ as a more relevant example.
Pg. 29, table	The table carries too many significant figures for a risk assessment; last two columns should not display more than 1 or, if it is important to distinguish between outcomes, 2 significant figures.
Pg. 40	The use of a 50% conservative multiplier for the EPA Region 3 risk-based concentrations (RBCs) seems unnecessary. The RBCs are calculated from EPA RfDs and CSFs, which in themselves have incorporated uncertainty factors of multiple values of 3 or 10. An additional conservatism in these screening levels appears superfluous.

Pg. 41 et seq.

The speciation of Chromium into Cr^{+III} vs. Cr^{+VI} is critical for the inhalation risk assessments. Yet no explanation is offered for the speciation used. In particular, the use of a 30% Cr^{+VI} fraction for the BG&E power plants is unexplained. If this is from direct measurements by BG&E, it should be so noted. EPRI data indicate that a more appropriate figure in general is about 15%; EPA in its utility air toxics report to Congress used an 11% Cr^{+VI} fraction for coal-fired power plants. Additionally, the fraction of Cr^{+VI} seems high for other sources as well.

United States
Environmental Protection Agency
Office of Pollution Prevention and Toxics
Ariel Rios Building (7406)
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460